EDISON
ELECTRIC INSTITUTE
BULLETIN

MARCH, 1938

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EDISON ELECTRIC INSTITUTE

STATISTICAL DATA OF THE ELECTRIC LIGHT AND POWER INDUSTRY

Compiled Monthly by the Edison Electric Institute—Covers 100% of the Industry

DURING THE MONTH OF DECEMBER

	1937 (b)	1936 (b)	%
Kilowatthours Generated (net) (a)			
By Fuel	6,182,601,000	6,562,843,000	− 5.8
By Water Power	3,317,033,000	3,285,547,000	+ 1.0
Total Kilowatthours Generated	9,499,634,000	9,848,390,000	− 3.5
Additions to Supply			
Energy Purchased from Other Sources	327,085,000	242,534,000	+34.9
Net International Imports	105,783,000	79,486,000	+33.1
Total	432,868,000	322,020,000	+34.4
Deductions from Supply			
Energy Used in Electric Railway Departments	61,171,000	59,879,000	+ 2.2
Energy Used in Electric and Other Departments	151,749,000	142,188,000	+ 6.7
Total	212,920,000	202,067,000	+ 5.4
Total Energy for Distribution	**9,719,582,000**	**9,968,343,000**	**− 2.5**
Energy Lost in Transmission, Distribution, Etc.	**1,670,420,000**	**1,590,348,000**	**+ 5.0**
Kilowatthours Sold to Ultimate Customers	**8,049,162,000**	**8,377,995,000**	**− 3.9**
Sales to Ultimate Customers (kwhrs)			
Domestic Service	1,706,862,000	1,504,165,000	+13.5
Commercial—Small Light and Power (Retail)	1,591,729,000	1,459,582,000	+ 9.1
Commercial—Large Light and Power (Wholesale)	3,866,515,000	4,571,140,000	−15.4
Municipal Street Lighting	243,400,000	218,316,000	+11.5
Railroads—Street and Interurban	421,993,000	420,119,000	+ 0.4
Railroads—Electrified Steam	118,117,000	122,984,000	− 4.0
Municipal and Miscellaneous	100,546,000	81,689,000	+23.1
Total Sales to Ultimate Customers	8,049,162,000	8,377,995,000	− 3.9
Total Revenue from Ultimate Customers	$189,276,500	$184,780,500	+ 2.4

DURING TWELVE MONTHS ENDING DECEMBER 31st

Kilowatthours Generated (net) (a)			
By Fuel	74,206,276,000	69,335,723,000	+ 7.0
By Water Power	40,959,360,000	37,230,590,000	+10.0
Total Kilowatthours Generated	115,165,636,000	106,566,313,000	+ 8.1
Purchased Energy (net)	4,644,712,000	3,119,045,000	+48.9
Energy Used in Electric Railway and Other Departments	2,322,903,000	2,276,245,000	+ 2.0
Total Energy for Distribution	**117,487,445,000**	**107,409,113,000**	**+ 9.4**
Energy Lost in Transmission, Distribution, Etc.	**18,041,081,000**	**17,364,848,000**	**+ 3.9**
Kilowatthours Sold to Ultimate Customers	**99,446,364,000**	**90,044,265,000**	**+10.4**
Total Revenue from Ultimate Customers	**$2,180,787,600**	**$2,044,586,900**	**+ 6.7**
Important Factors			
Percent of Energy Generated by Water Power	35.6%	33.4%	
Domestic Service (Residential Use)			
Average Annual Consumption per Customer (kwhr)	802	735	+ 9.1
Average Revenue per Kwhr (cents)	4.40¢	4.67¢	− 5.8
Average Monthly Bill per Domestic Customer	$2.94	$2.86	+ 2.8

BASIC INFORMATION AS OF DECEMBER 31st

Generating Capacity (kw)—Steam	24,637,926	24,106,618	+ 2.2
—Water Power	9,634,014	9,538,640	+ 1.0
—Internal Combustion	688,381	614,813	+12.0
Total Generating Capacity in Kilowatts	34,960,321	34,260,071	+ 2.0
Number of Customers			
Farms in Eastern Area (Included with Domestic)	(922,602)	(766,713)	+20.3
Farms in Western Area (Included with Commercial—Large)	(318,903)	(276,211)	+15.5
Domestic Service	22,620,117	21,754,153	+ 4.0
Commercial—Small Light and Power	3,891,584	3,825,289	+ 1.7
Commercial—Large Light and Power	578,581	556,235	+ 4.0
Other Ultimate Customers	73,705	70,202	+ 5.0
Total Ultimate Customers	27,163,987	26,205,879	+ 3.7

a By courtesy of the Federal Power Commission, with deductions for certain plants not considered electric light and power enterprises.
b Revised monthly series.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 6 MARCH, 1938 No. 3

Atlantic City Again for the June E.E.I. Convention

AFTER a lapse of three years, during which time the Institute's annual Conventions were held in other cities, the E.E.I. will again meet in Atlantic City for its 1938 Convention on June 6 to 9 inclusive. The Convention will be held in the Atlantic City Auditorium as the smaller assembly rooms of the city's hotels have been found inadequate to seat comfortably the delegates to former conventions, this being particularly true of the last one held in Atlantic City, in 1935.

The business program is approaching completion, while preparations for other Convention affairs also are going forward smoothly both at the Institute's general offices and at Atlantic City, where the Atlantic City Electric Company, which will be the official host of the Convention, has taken over the job of preparing for the delegates' comfort and entertainment.

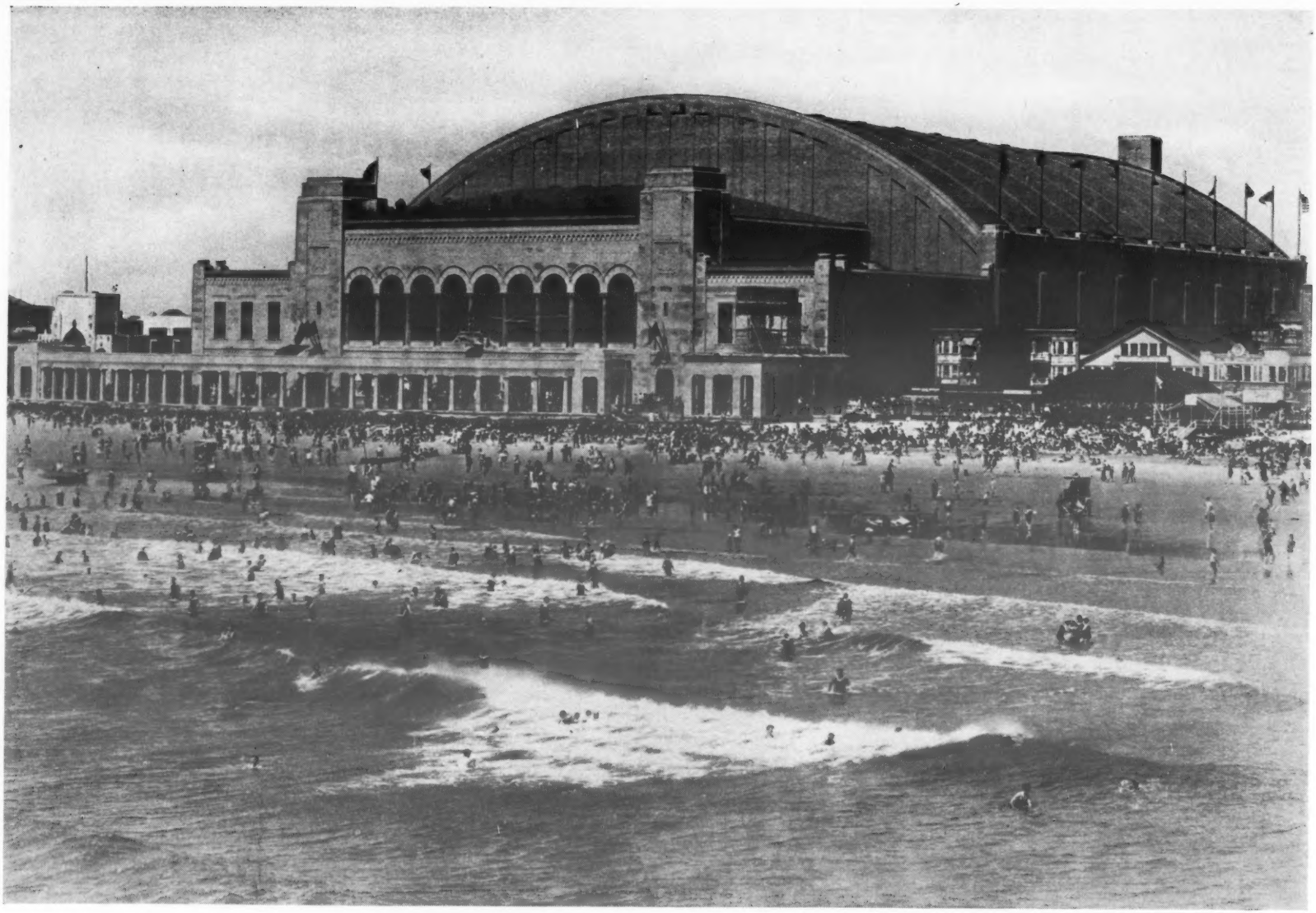
Of outstanding importance will be a discussion of the outlook for private industry in this country by several distinguished economists who have been invited to address the Convention. In the main, the business program will be devoted to the broader aspects of management, public policy, finance and administration, since the more technical problems of the industry can be best handled through specialized meetings, such as the National Sales Conference in Chicago this month, the National Accounting Conference held recently at Detroit, and the National Conference of our Engineering Committees to be held in Chicago early in May.

The first day of the Convention, Monday, June 6, will be given over to the registration of delegates, committee meetings and informal work of the Convention. The President's Reception will be held during the evening of the same day in the Rose Room of the Hotel Traymore. The general sessions will be held on Tuesday morning, June 7, on Tuesday afternoon and on Wednesday and Thursday mornings, all in the Grand Ball Room of the Atlantic City Auditorium.

One of the high points of the Convention will be a Banquet to be held at 7:30 Wednesday evening, June 8, in the American Ball Room of the Hotel Traymore. Messrs. E. A. Lewis, Vice-President and General Manager, and R. E. Swift, Assistant General Manager of the Atlantic City Electric Company, have generously volunteered their services in handling the details of the Banquet, and other entertainment of the guests. Special entertainment will be provided on Tuesday afternoon for the ladies in attendance and a dance will be given on Tuesday evening, as well as on Monday evening after the President's Ball and Wednesday evening following the Banquet.

The Convention hotel and transportation circular will be mailed to all member companies at an early date. Inquiries to the general offices of the Institute indicate a large attendance and it is suggested that hotel reservations be made at the earliest practicable date with the hotel of choice.

A close-up view of the facade of the Atlantic City Auditorium



E.E.I. CONVENTION HEADQUARTERS, JUNE 6-9, 1938

(Another view of the Atlantic City Auditorium)

(Another view of the Atlantic City Auditorium)

Measures For The Maintenance Of Good Physical Health

By J. J. Wittmer, M.D.
Medical Director, Consolidated Edison Company of New York, Inc.

THE maintenance of a healthy state in employees has a two-fold advantage in industry. It not only means that a healthy employee is more alert, and more efficient in preventing unusual occurrences concerned with his job and thereby aborting a possible injury, but also the healthy employee is on the job more continually, is consistent in effectiveness, and his capability for full production is unimpaired. We often lose sight of the fact that for every employee that is absent from work, that there are two others on the job who have a decreased efficiency because of some subacute or chronic illness.

Industry should be fully aware of the fact that an accident prevention program demands a healthy mind and body in the worker and further, that effective work can only be obtained from the employee who is mentally and physically sound. The question which naturally should arise is how can employees be kept in such physical condition that they will be fully productive and non-accident prone. There are several outstanding ways that this can be accomplished.

1. The examination and classification of all applicants for employment.
2. The re-examination of all employees at definite intervals.
3. Medical supervision to ascertain whether or not an employee should remain on the job because of an actual or apparent illness.
4. The follow-up of these employees while they are ill.
5. The examination of all employees before they are allowed to return to work after an illness.
6. The education of all employees in personal hygiene procedures.
7. Immediate treatment of all injury cases and adequate, painstaking medical treatment and control of these cases throughout the entire period of disability of the injured worker.
8. Complete rehabilitation of the patient so far as is possible by proper reconstruction treatment in order to reduce the loss of deformity, to that point where medical science has not found means of effecting repair.

Most companies have realized for a number of years that the physical examination of applicants is of vital importance. Some companies feel that it is worthwhile to examine those doing mechanical work, while others provide physical examination for clerks only, and a number of organizations neglect to examine those who should be considered the most important group from an accident standpoint, viz., "the laboring class."

DR. WITTMER

This is the fourth of a series of articles on Medical Service in Industry, prepared by the Subcommittee on Health, of the Accident Prevention Committee, E.E.I., composed of: Dr. Hart E. Fisher, Chicago; Dr. Noel G. Monroe, Boston; Dr. J. J. Wittmer, New York City; Professor Morris S. Viteles, Philadelphia and Wills Maclachlan, Toronto, Ont., Chairman.

These articles will appear monthly in the BULLETIN *and will present different phases of the types of assistance that can be given to industry by the Medical Profession.*

The Subcommittee will welcome comments and discussion of these articles. These comments should be addressed to the

SUBCOMMITTEE ON HEALTH
Edison Electric Institute
420 Lexington Ave., New York, N. Y.

This, of course, is probably due to the fact that the work is transient and the turnover very heavy. Experience has demonstrated that all applicants for employment, regardless of the work they are to do, should be examined. A definite physical standard should be set up for each type of job. The requirements should be rigid and no employee should be transferred from one type of work to another without a checkup to see if he fits into this new physical classification. One must remember in setting up physical requirements for different types of work that the non-manual job sometimes requires temporary manual work, and adding this momentary hard work to a weak musculature in a man who is not used to it, is doubly inviting physical injury.

Physical examination in industry need not be the "so-called health examination" as given by a private physician, which takes one to one and a half hours to do, but should cover the major points of physical stock-taking. Noting, particularly, gross abnormalities and their relation to the existing hazards in certain jobs, and checking signs of beginning chronic disease, is an asset to an employer and of inestimable value to the employee. One can easily see that an individual with high blood pressure, with a potential dizziness, weakness, and unsteadiness, is not only always in constant danger of falling, but even after an accident has occurred, he is a possible total functional loss and certainly has a much prolonged period of disability. The person with weak musculature is more likely by far to have an actual hernia than one who has a strong abdominal wall, and a man with a potentially weak back needs only to stoop over and

pick up a few pounds, get a kink in his back, and be a chronic invalid for the rest of his life. The employee with arteriosclerosis, particularly the generalized type that involves the heart, with the possibility of an intrinsic, instantaneous cessation of heart action, who collapses while carrying a moderately heavy beam near an opening in the street, presents a problem which is usually to the disadvantage of all concerned. Defective vision is not only a distinct hazard to the employee himself, but if he happens to be in such a position as to injure others, the outcome may be very grave. A physician keenly aware of the possibility of these conditions can very definitely ascertain these defects and eliminate the risk.

It is not always necessary to reject an applicant for employment. In fact, the greater number of people who are examined for employment should fit into some job in industry. The examination should be able to bring out any defects which precludes the applicant from certain types of work, and the physician who can fit a picture of the physical condition into the frame of the job, has not only accomplished something that will be of advantage to the employer and to the employee, but also has added to the general welfare of the community.

During the course of the examination the doctor should also carefully note any defects or deformities that may be present so that when an employee does have an accident the old condition can be differentiated from the new. The exact notation of the amount of visual defect at the time of employment may be the means of combating a claim of alleged visual loss after the accident.

Deformed joints, especially where there is only a partial loss of function should be noted, with particular emphasis on the extent of loss of motion. For instance, a man originally having a 50 per cent loss of flexion of the wrist may sustain a fracture of that wrist. After the injury has cleared up the wrist may have a loss of 70 per cent flexion. If the original loss of disability has been noted the company would have to pay the 20 per cent difference.

Facial disfigurements frequently cause controversies at the Labor Department hearings. Scars that have been on an employee's face for several years are noted by him for the first time a week after a fuse blew and slightly scorched his face. In this connection a man had an injury caused by having his neck caught between two converging bars. After a prolonged convalescence he returned to work, but a year after the accident he maintained that due to the disturbance of circulation in his head while his neck was caught between the bars, his internal glandular system was disturbed in its functions and was now causing his hands to become grossly enlarged, his cheek bones to markedly protrude, the prominence of his forehead to bulge and his nose to widen and flatten. The man produced a picture of himself that had been taken some ten years previously which demonstrated a normal facial contour and for comparison a picture at the present sitting showing the extreme changes in his physiognomy. Fortunately, however, the employer had photographed this man at the time of employment three years previously and this picture showed that there were very slight differences in the general outline of the face when compared with the last picture which was presented.

The physician who investigates the possibility of the presence of arthritis on the first examination will save the employer and himself untold time and energy. Noting the ease with which the man bends forward to touch his toes, or bends laterally, or is able to bring his weight sharply down on his heels without evincing signs of pain, or demonstrates the presence of arthritis in other parts of the body, such as the fingers, or the history of long continued hard labor, and the presence of muscle spasm, are all points in spotting this condition.

Serious difficulties which may be encountered by a company can be avoided by physical examinations when we note that in a series where 5,173 laborers were examined in one year, 1,072 were definitely rejected. Analyzing these rejections, 347 were for uncorrectable defective vision, 129 for advanced cardiac conditions, 317 for hypertension and 104 for frank herniæ, while the rest of the rejections were scattered under such headings as marked varicosities, skin conditions, crippling deformities, deficient hearing and chronic lung disease.

Examination of employees at periodic intervals after employment serves a very definite purpose. First, it reveals any condition which is germinating in the individual. Degenerative conditions such as diabetes and nephritis must have to start at some time in a very small way. Ascertaining these conditions in their very incipiency and properly regulating the individual's daily regimen may eliminate the diseases entirely in some cases and in most of the other cases it will tend to stop the progress toward chronic illness and invalidism. We then not only have a healthy continuous worker, but a keen employee with less likelihood of injury. Second, a minor defect which was either unrecognizable or thought to be of little importance at the original examination may now be advanced enough to be very apparent. This condition if allowed to go on could cause embarrassment to the other organs and finally fulminate with disaster to the person involved. Third, the employee has not been able to stand the strain of the work as well as had been expected; his vision is less acute, or his heart is slightly weaker, or he has lost weight and numerous other conditions may be present. The transfer of these men to jobs that are more fitting to their physical make-up relieves the tension and makes for happier, healthier and more alert employees. Fourth, an employee doing the same routine work day after day and year after year becomes set in his physical make-up, rutted in his mental reactions, and a definite psychical inertia sets in. Any exigency which occurs aside from the usual daily regimen is answered by the person only after long and arduous thought. He must bring up from the buried depths, brain-cell connections which take care of this unusual occasion and in a strange manner associate facts in his brain over a period of several minutes which ordinarily ought to take but a fraction of a second. Physical and mental stock-taking of these individuals will elicit facts that will guide supervisors to train these men in other channels and in some cases cause transfers to other jobs where there are no exigencies which entail quick reactions to hazards.

Recently examination of about 450 chauffeurs in an industry revealed many of these men who originally were acceptable two to five years before, now had serious conditions which needed correction. Eight per cent had visual defects which rated them as definite risks as drivers. Happily, only four had eyesight which was not correctable to a point allowing them to drive, while the others had normal vision returned to them with the application of glasses. About 15 had developed herniae since the last examination, 21 had a beginning hypertension, which while it did not incapacitate them as far as their job was concerned would have become so if they

had not been advised as to its reduction.

About five years ago, 1,664 laborers who had never been previously examined were checked up by a Medical Department. It was found that 522 of these men had conditions which made them definite risks on their jobs. Some of the causes were:

Defective uncorrectable vision	159
Advanced heart conditions	61
Hypertension	137
Frank herniae	97

Of the 1,142 others, 205 had defects of various kinds with definite need for correction but which were not serious enough to be a hazard. I must repeat that laborers are exposed to accidents more than any other group of workers.

It may not be possible from a financial or labor standpoint to meet the ideal condition of yearly examinations. If this obtains, then a modified program should be outlined whereby it is mandatory for those working in the more hazardous occupations to be examined at definite intervals, e.g., chauffeurs under 35 years of age—each three years; under 45 years of age—each two years and over 45 years—each year. The same should hold true for crane operators, linemen, splicers and others who work with live wires. Laborers on a general average should be examined at least once in five years. Also, in this connection, those who do not have hazardous jobs but require special sense alertness should have these senses checked up regularly. The telephone girl for vision and hearing; those working around and in manholes for smelling ability; and indexers for visual acuity.

The constant supervision of a physician who can detect signs of disease in an employee and temporarily absent him from the job is invaluable in preventing accidents. The severe cold with its toxic effects, probable tearing of the eyes, a degree or so rise in temperature; an ulcer of the stomach with a constant dragging, gnawing sensation in the pit of the abdomen; a heart condition which only causes shortness of breath on exertion; a moderately increased blood pressure, with its concomitant lightheadedness and periodic dizziness; a chronic tonsillitis, with constant absorption into the blood of toxic material which in turn causes a feeling of lassitude and malaise; diabetes and kidney conditions which sometimes for years only manifest themselves by a feeling of tiredness, weakness and often blurring of vision; and innumerable other ailments that are not necessarily incapacitating; but need I emphasize that the employee is more prone to accident when suffering with such conditions.

A solicitous interest in the man when he is ill at home by a visit from the doctor or the nurse instills a spirit of fraternalism which is continued when he returns to the job. He is much more willing to cooperate as part of the "big family" in the accident prevention program. The company had shown an interest in him when he was down, which he is now anxious to reciprocate by making every effort to do the job in the right way.

Every employee who has been absent from work for more than three days because of illness should be examined by the doctor before he is allowed to return to work. No one can be sure of the reason for the man's absence. A conscientious worker will often return before his illness has even partially cleared up. Too often the residue of an illness is more devastating than the illness itself. Commonly the illness causes an exacerbation of a chronic condition or lights up an old smoldering subacute disease. At present when occupational disease is considered as "any illness that arises during the course of work," the possible contamination of a scarlet fever, measles, or diphtheria case, and particularly the tuberculosis cases, returning to work before the disease has expended itself, can cause unusual inroads into the compensation budget. Also, weakness, dizziness and uncertainty of physical movements in a worker who has just returned from an absence due to illness have accounted for many serious injuries.

If this program is too ambitious for some concerns, certainly employees who have suffered prolonged illness or serious acute conditions should be thoroughly investigated. A program of this kind may be the means in time of covering most of the employees for periodic physical examination.

One cannot take the space that would be necessary to cover the relation of unusual mental reactions to accidents, but I will emphasize that foremen can and do aid materially in keeping the accident rate low by knowing the characteristics of their men, their home conditions and are able to ascertain when these conditions change. A man with a seriously ill wife or child cannot keep his mind on every detail of a complicated job. The fellow who is going to be married tonight certainly is not in tune with all the hazards of his surroundings. The employee who expects that a collector is going to be at the door at lunch-time to dun him for last month's rent has his mind on how to stall him off another month. An effort to solve these problems may take time but not nearly as much time as it does to heal a broken leg or an amputated arm.

Education in personal hygiene on a mass basis has accomplished much in the maintenance of a healthy state. If, however, this education could be given in a personal way from an individual standpoint, I believe it would be much more beneficial. This can be accomplished by combining the periodic physical examination with a personal, frank talk by the examining doctor. This doctor has taken the individual's history of the employee's daily program as well as any untoward symptoms, he has performed his examination and now he tells the person what he has found wrong, why it is wrong, what he has been doing to make it wrong, how it can be corrected and how it can be avoided in the future. This education strikes home, is to the point, and cannot help but make an impression. In addition, the employee has not received a whole mass of information about all illness which, according to his imaginative powers, he might apply to himself and, as a result, in time become a full-fledged hypochondriac.

We must not only think of maintaining a healthy employee in our program for accident prevention, but we are obligated to restore health to the injured individual. This obligation performed in the proper manner also returns to the job a willing worker who now enthusiastically endeavors to do the best he can and can do it because his body is in prime condition and his limbs are unimpaired.

The effects of medical care of an injured worker depend largely upon the experience of the physician who is treating the case. It is essential if a doctor is to be successful in traumatic work that he look at each injury as an analyst, as a scientist, as a lawyer, and as a business man. First, he should be particularly definite in his diagnosis. All accident cases demand a thorough physical checkup with the patient completely stripped. An individual may only complain of a severe contusion of the hand, the pain in this member often overshadows the abrasion on the leg which is discovered later when he disrobes to retire. Cases of so-

called back strain may be treated for days until the patient himself notices a bulging in his inguinal region. The rigidity present after a person receives a severe blow in the abdomen may go unnoticed for hours and a ruptured spleen or liver neglected because the individual in his frenzy to get home has convinced the doctor that he feels all right. The physician specializing in traumatic work must be exceedingly careful in the wording of his diagnosis. His records should be clear, accurate and up-to-date. In making a diagnosis the doctor must be guided more by the signs than by the symptoms. If he can find no signs of injury, he should state that he can find no objective signs but subjectively the patient complains of pain, dizziness, etc. We must realize that a diagnosis that is made must be substantiated before a legal body. A Claim Department of a Company can be materially aided in its decisions by the definite and complete diagnosis of the doctor. However certain he is of the accuracy of his diagnosis in a traumatic injury, he must have every possible proof of its correctness. He must make free use of the laboratory for corroborative tests. X-rays must be taken on the slightest provocation. He must realize that even though he is definitely convinced that he has made a correct diagnosis, he may have actually to prove his contention to a referee who has already heard an opposite opinion given. Every accident case no matter how trivial is a potential source of medico-legal debate. There is no better proof than certified laboratory reports and pictures of the structures taken immediately after the accident. The doctor in addition must have an inquiring mind. He should be ready to adopt and endorse the employment of methods of treatment which may be new and yet which have been soundly established as desirable. He should be a diplomat of the highest order so that he may successfully handle both the patients and the many others who are indirectly concerned. He should be accessible at all times, and this accessibility should not be merely physical, but should be psychological.

In continuing the discussion of proper medical attention, I must include without distinct differentiation rehabilitation work, because rehabilitation work commences at the moment the accident occurs. The doctor must keep in mind that the severity of the accident depends upon the outcome of the injury. For instance, a pin prick may not seem to be a severe accident, but if the outcome of that injury is the loss of a member through infection, it is an extremely severe injury. Usually the outcome of the injury is very greatly affected by the nature of the treatment, and a great responsibility therefore lies upon the doctor. The severity of the accident depends upon the time lost from work and the extent of the deformity. A vast amount of lost time can be saved and inestimable good done by intelligent and persevering care from the moment the injury happens until it is finally cleared up.

Close supervision of each patient by the doctor permits the instituting of early remedial measures and aids in the restoring of complete usefulness. There should always be immediate antisepsis of an injury by the First Aider, followed immediately by review by the doctor and again by a second review by the doctor within 48 hours. It is only in this way that the physician can ascertain that infection is commencing and take steps to stop any further invasion of the pathogenic organisms. The average lay person does not recognize the signs of early pus formation and therefore will only voluntarily return for treatment when the infective process is in full bloom. If the doctor is given the cooperation of the patient and the Company, the occurrences of preventable infection can be brought to a bare minimum.

If an infection has taken place, the close surveillance of the injury by the doctor permits the instituting of extreme measures to curtail any further invasion of the tissues. Inflammation in a limb that is being moved or irritated by clothing or suspended so that drainage is poor, fulminates rapidly and spreads extensively. Rest, freedom from work, and constant applications of abortive solutions, may obviate the complication in a few days whereas partial treatment and light work may result in weeks and even months of lost time.

Passive motion of parts that have been splinted after a fracture should be instituted immediately after knitting occurs. Movement of badly burned areas should be required as soon as possible, even at the risk of breaking down healing tissue, to avoid resulting deformity and loss of function.

In prescribing treatment for an injury, if two courses of action are possible, that method must be pursued which will restore the patient to the greatest possible usefulness. It is obvious that from any angle of economic or humanitarian consideration that a longer course of treatment in some cases is cheaper and better.

Such decisions require that the doctor have more than a superficial interest in the successfulness of his work. It is easier to dismiss a sprained back after strapping it up and telling the man to return in a week or two or telling him to take it easy for a while and come back if the pain does not go away. All sprains, particularly of the back, should be investigated for diseased conditions which usually extend the period of incapacity beyond that reasonably to be expected from the immediate injury. Such diseased conditions may be found in diseased tonsils, bad teeth, etc. Such thorough investigations with attendant costs are often considered to be a waste of money by some laymen. These laymen have not grasped the significance of our present Workmen's Compensation Laws which can force a company to pay for the disability of the worker resulting from an aggravation of a previously existing condition when such aggravation results from an accident.

Similar to the problem of sprains in traumatic procedure, is that of the treatment of eyes. Beginning in the field and ending in the doctor's office there is probably no class of frequent injuries which is so constantly mistreated in industrial organizations. Most textbooks on First Aid make the serious error of advising attempts to remove foreign bodies from the eye at the time they enter, by the use of some handy material such as a handkerchief or even a match stick. It should be an offense involving discharge for an employee to remove anything from a fellow employee's eye in the field. That should only be done by a doctor and preferably by an oculist. The First Aid treatment should be the insertion of so-called eye ointment or petroleum jelly and the bandaging of the eye, followed by immediate attention by the doctor. In any eye case, whether it involves merely a slightly imbedded foreign body, a scratch to the cornea of the eye, an irritation or injection, the eye should be examined by an oculist and this opportunity taken of determining the employee's visual acuity and the general health of the eye. Such examinations frequently disclose a diseased condition which might be later attributed to the accident. Frequently the oculist

will find that the employee's eyesight is defective, and no arguments need be advanced to impress upon you the importance of correcting defective eyesight in order to prevent accidents. This absolute rule of examination of each injured or irritated eye by an oculist guarantees as much as possible against infections, ulcers, or scarred corneas through neglected abrasions, and against defective vision due to retinal reactions from intense variations of light. Once this procedure is instituted the occurrences of such infections, ulcers or visual defects due to failure to conform to these rules, stand out as striking examples to be used in educating the employee to the importance of obedience to the regulation concerning reporting of accidents and obtaining the proper treatment. The problem which seems insuperable at the outset gradually solves itself if given a reasonable degree of emphasis by the medical and accident prevention organizations.

Again when the force of the blow should have caused a serious injury—regardless of how slight the signs and symptoms may be, always treat the injury as serious until it is absolutely proved to be otherwise.

Finally an injured employee should be discharged as cured, only after every implement known to medical science has been brought into play to restore full function to the individual.

We have reason to believe that such provisions as are advocated here are justified because of these results:

1. A definite decrease in the number of serious injuries—cases are not prolonged because of complicating degenerative diseases.

2. The reduction of severity, i. e., fatalities lessened, lost time reduced for all types of general injuries.

3. A very low incidence of infection as a factor in our problems.

4. The very considerable reduction of compensation awards for deformities and permanent partial disabilities.

5. The improved morale of the working forces due to their knowledge and appreciation of the genuine interest and efficient care being taken of them by their company.

6. The increased working ability of the men in the field through their being kept as nearly as possible in first class condition in so far as physical disability is concerned.

You will note that the humanitarian side of this general problem has not been emphasized. Elaboration of this theme is neither necessary nor desirable. It should be apparent to everyone, that if suffering is prevented or decreased, if the loss of time for a given injury is reduced, if deformity and permanent disability is prevented and if the employee's opinion of the company is changed from that of distrust and cynical misunderstanding to pride and appreciation, the humanitarian aims of the medical and executive organizations have been fully attained.

Judges Are Announced for 1938 Prize Awards

JUDGES for the several prize awards administered by the Edison Electric Institute for the year 1938 have been announced by Mr. H. P. Liversidge, Chairman of the Prize Awards Committee.

The closing date for papers entered for the Byllesby, Forbes, Lindemann and McGraw prizes was March 1, and the closing date for the Coffin, Curtis, Hughes, and Martin awards is April 1.

Announcements of the prize winners will be made at the Edison Electric Institute convention in June.

The judges are:

H. M. BYLLESBY PRIZES

Dean JOHN T. MADDEN, *Chairman,* New York University, Washington Square East, New York City.

B. F. BRAHENEY, Vice-President, Public Utility Engineering & Service Corp., 231 South LaSalle St., Chicago, Ill.

W. PAXTON LITTLE, Treasurer, Niagara Hudson Power Corp., 15 Broad St., New York City.

B. C. FORBES PRIZE

J. F. OWENS, *Chairman,* President, Oklahoma Gas & Electric Co., Oklahoma City, Okla.

A. J. VAN DERZEE, Vice-President, The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

(Another member to be appointed.)

A. L. LINDEMANN PRIZES

L. E. MOFFATT, *Chairman,* Editor, *Electrical Merchandising,* 330 West 42nd St., New York City.

MISS MILDRED NICHOLS, Director, Home Economics, Graybar Electric Co., Inc., 420 Lexington Ave., New York City.

MISS ADA BESSIE SWANN, Director, Home Service Center, The Crowell Publishing Co., 250 Park Ave., New York City.

JAMES H. McGRAW PRIZES

JOHN C. PARKER, *Chairman,* Vice-President, Consolidated Edison Co. of New York, Inc., 4 Irving Place, New York City.

J. T. BARRON, Vice-President, Public Service Electric & Gas Co., 80 Park Place, Newark, N. J.

W. I. SLICHTER, Professor of Electrical Engineering, Columbia University, New York City.

CHARLES A. COFFIN AWARD

C. W. KELLOGG, *Chairman,* President, Edison Electric Institute; Chairman, Engineers Public Service Co., Inc., 90 Broad St., New York City.

KARL TAYLOR COMPTON, President, Massachusetts Institute of Technology, Cambridge, Mass.

H. P. LIVERSIDGE, Chairman, Prize Awards Committee—Edison Electric Institute; Vice-President, Philadelphia Electric Co., 1000 Chestnut St., Philadelphia, Pa.

AUGUSTUS D. CURTIS AWARD

HOWARD C. MYERS, Editor, *Architectural Forum,* 135 East 42nd St., New York City.

S. R. McCANDLESS, Instructor of Lighting, Yale University, New Haven, Conn.

KENNETH MAGERS, Advertising Manager, The Cincinnati Gas & Electric Co., Cincinnati, Ohio.

GEORGE A. HUGHES AWARD

RALPH H. JONES, President, Ralph H. Jones Company, Carew Tower, Cincinnati, Ohio.

ELL C. BENNETT, President, Bennett-Watts-Haywood Co., 1836 Euclid Ave., Cleveland, Ohio.

HUGH E. AGNEW, Chairman, Dept. of Marketing, New York University, New York City.

THOMAS W. MARTIN AWARD

PHILIP S. ROSE, Editor, *Country Gentleman,* Curtis Publishing Co., Philadelphia, Pa.

DR. E. A. WHITE, Director, Committee on Relation of Electricity to Agriculture, 58 East Washington St., Chicago, Ill.

GEORGE W. KABLE, Editor, *Electricity on the Farm,* 24 West 40th St., New York City.

As the Cartoonists See the TVA Controversy

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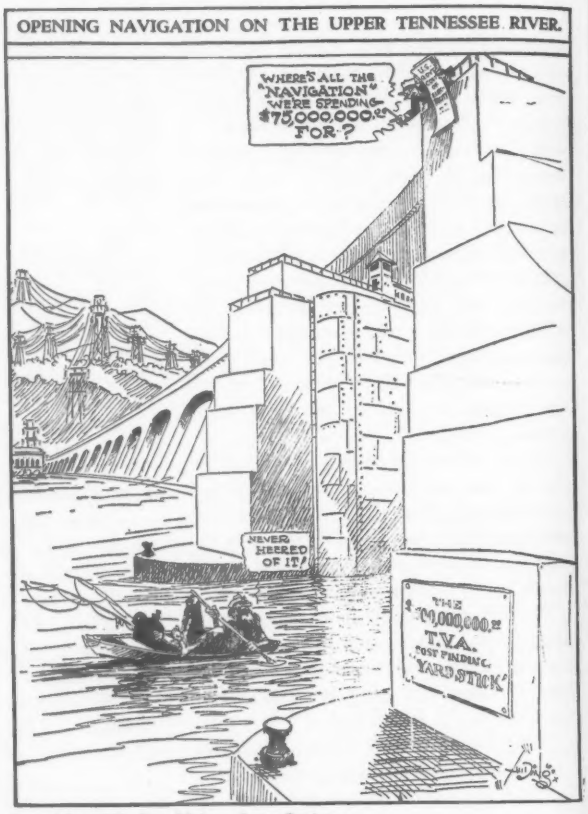
OPENING NAVIGATION ON THE UPPER TENNESSEE RIVER.
WHERE'S ALL THE "NAVIGATION" WE'RE SPENDING $75,000,000 FOR?
NEVER HEERED OF IT!
THE $90,000,000 T.V.A. COST FINDING YARDSTICK

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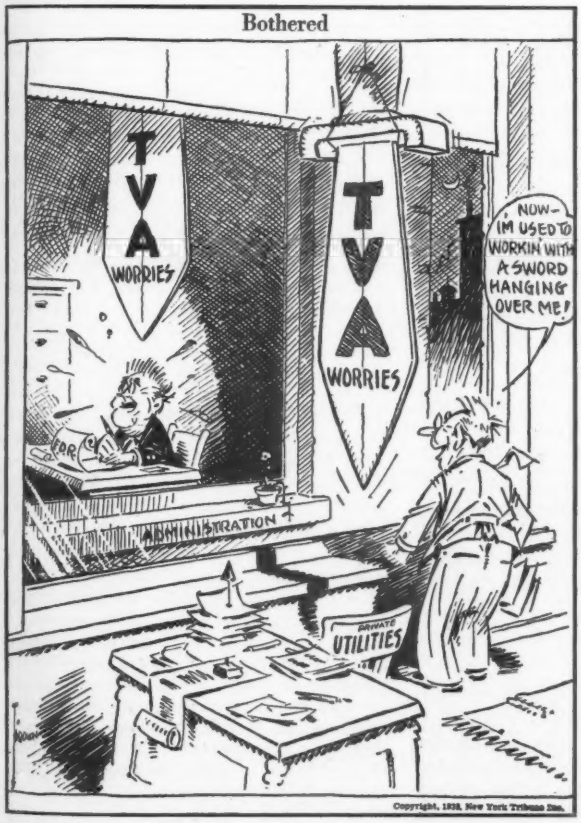
Bothered
T V A WORRIES
T V A WORRIES
NOW- IM USED TO WORKIN WITH A SWORD HANGING OVER ME!
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Modern Poor Richard.

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Gas Pressure Relays

Final Report on Analysis of Replies from Foreign Correspondents to the Electrical Equipment Committee, E.E.I.

R. A. Hentz, *Sponsor*

FOURTEEN replies were received to the questionnaire sent out by the Electrical Equipment Committee of the Edison Electric Institute through the Foreign Practice Group on the use of the gas pressure relay.

A digest of these replies is given herewith.

Historical

Experimental work on the gas pressure relay was started in 1924 and the relay was applied to practice the following year. With the exceptions of one country, where the relay is not used; one, where the relay has been used extensively only within the last year; and one, where only one trial installation was made in 1931, the remaining countries indicate a general use of the relay from ten to fifteen years. It appears that about 80% of the transformers in Germany over 5000 kv-a, somewheres between 10 and 25% of the transformers in Sweden over 1000 kv-a and about 20% of the transformers in Switzerland are so equipped. In Belgium the use of Buchholz protection is almost general.

Application

In practically all cases the relays are supplied by the manufacturer with the transformer, although occasionally relays have been added at a later date by the customer. There is apparently no definite limit as to the minimum size of transformers so protected.

The relay is almost always connected to sound an alarm on the slow accumulation of gas and trip the bank on the sudden appearance of gas pressure. The practice of using balanced protection, in addition to the gas pressure relay, varies materially. Three correspondents state that both types of protection are used in order to provide protection for the bushings and switches. Three other correspondents state that current differential protection is not used with the gas pressure relay. In one country these gas pressure relays are also applied to auxiliary and grounding transformers with the main transformer installations.

Experience

The degree of protection has been stated generally as fair, satisfactory, good or excellent. One experimental installation was considered to be unsatisfactory and in one country the installations were too new to warrant an expression of opinion.

All correspondents mention the fact that air must be excluded from the transformer before the protection is supplied, or otherwise false indications will be obtained. In fact, some correspondents go so far as to state that this is an advantage of the relay in so much as entrapped air allowed to remain in a transformer may be the cause of failure. A common cause of entrapping air seems to be due to the practice in Europe of circulating the oil in the transformers. They also make a point of the fact that the relay is inherently an oil level indicator. All correspondents, except one, feel that the value of the slow accumulation of gas alarm feature is fully justified.

Advantages

The advantages cited are simplicity, sensitivity, ability to check failures at their inception with the associated advantages of diminishing the extent of the damage to the transformer and the elimination of elaborate testing to indicate that the protective system is properly connected. Particularly mentioned is its ability to respond to turn faults and to check faulty operation of tap changer equipment.

With the exception of one country, where a 10% reduction in insurance is granted, apparently no reduction in fire insurance rates has been obtained due to the use of this device, although one correspondent points out that because the damage to the transformers has been minimized, the insurance companies are more ready to settle in full for the damage. Some correspondents stated that there were no theoretical disadvantages, others cited the possibility of operation by the oil circulating pump, the excessive royalty costs and necessity for making a thorough test on each model. One correspondent stated knowledge of a case where the tripping float did not function fast enough to prevent serious damage to the transformer.

Miscellaneous

Apparently most European transformers are provided with a conservator, all transformers in Germany being so arranged. One correspondent mentions attempts which have been made to apply the device to transformers not equipped with conservators. One correspondent states that a similar relay, known as "Bendmann Protection" can be applied to such transformers.

The correspondents state that the gas pressure relay is applicable to tap changers, static condensers, Peterson coils and induction regulators. One correspondent mentions tests made for use on alternators with the relay arranged to measure the density of the circulating air.

Pertinent abstracts from the letters received are as follows:

Foreign Comment

1

"After installation these relays functioned to sound the alarm on several occasions, on none of which was any trouble found in the transformer bank to justify their action. Apparently, a healthy transformer will generate a small amount of gas in the oil without any difficulty existing in the windings. This gas, which accumulated in the relay, caused it to operate while the transformer was perfectly sound. Some of the operations occurred without the presence of gas, which indicated that the relay was sensitive to vibration or shocks which did not originate from defects in the transformer units. After being left in service for about four years, they were disconnected as a result of lack of confidence in their indications for the reasons as outlined above."

* * *

2

"Our experience indicates that the slow gas accumulation alarm device of Buchholz relays, even when they are already protected with differential protection, is justified. The history of the only operation on our system of these relays is given below, being an extract from a field report:

"The high tension switch of bank No. 2, the switch of generator No. 2 and tie No. 2

tripped simultaneously and the Klaxon alarm rang.

"Upon opening the transformer we found that there had been a small flash at the tap changing switch and that the contacts had been somewhat burnt so that we are now proceeding to replace these contacts by others we had in our stores, then we are planning to test the transformer with partial voltage and put the unit back into service. It is interesting to note that in this case the differential protection had no opportunity to operate as there was no short circuit or flash to ground and the arc was limited to play between the loose contacts establishing a partial open circuit. The Buchholz protection showed its value by limiting the damage to a negligible proportion'."

* * *

3

"The gas pressure relay is now being applied to all new transformers on our system. It is also being applied to all unit auxiliary and earthing transformers and to all main power transformers as and when they are taken out of service for repair.

"In our opinion, the gas pressure system of protection has marked advantages in simplicity and economy over any other system of transformer protection. It is, however, to be recognized that it does not afford protection to bushings and therefore does not replace balance protection, but only supplements it.

"We have had two cases of relays functioning on an unfaulted transformer due to the oil level being incorrect. These cases, however, cannot be counted against the gas pressure relay. There was also one case of a relay functioning due to it being put into service before all air had been driven off the windings of a new transformer.

"There has been no case in which a relay has failed to function on a faulty transformer.

"We have had one case of successful operation in which a core fault was cleared at a very early stage in its development.

"The only serious disadvantage of the gas pressure relay known to us is the excessive royalty cost. It must, however, be mentioned that in spite of the apparent simplicity of the gas pressure relay, it is essential to make a most thorough type and routine test on each model. It is further essential to recognize that many existing transformers are so designed that gas accumulations may be extensive before the gas starts to flow through the relay. It is, therefore, important to study the design of the transformer covers and their connections to conservator to get the most effective results from gas pressure relays."

* * *

4

"We do not use differential protection, it being too expensive, the functioning difficult to inspect and, in our opinion, much less effective than Buchholz relay protection.

"Certain faults, such as short circuit between turns, arcs to ground, insufficient oil in the transformer tank, have been eliminated by the functioning of the Buchholz relay.

"Certain faults have been eliminated entirely in the beginning, so much so that it was necessary to disassemble and make very complete searches in order to be able to show up the faults.

"Protection by the Buchholz relay has always eliminated the internal faults in the transformers before severe damage was caused.

"In case of shortage of oil, either on account of a leak in the tank or extreme cold, the alarm operated by the relay functions, which permits intervening in time.

"I do not know of any other example of the application of the gas relay than for transformer protection, although certain tests have been made in order to use these relays, with certain modifications, for the protection of alternators functioning with closed circuit ventilation." (One company indicates that in this case the relay is arranged to measure the density of the circulating air.)

* * *

5

"It was particularly noted that in the first years of application incorrect operations occurred due to improper construction of the oil circulating system, in that the circulating pumps sucked in air which was not extracted in the air separators provided. This air accumulated gradually in the Buchholz relay and finally the relay reacted. Also after maintenance on transformers, it has been noticed from time to time that small air bubbles have accumulated in similar manner. If the protection is used for alarm purposes, as is normally the case, and if it has been established that the accumulated gas is not combustible, then there is no reason to consider the operation of the relay as a disadvantage in regard to the service. The operation of the relay caused by the lowering of the oil level as a result of severe cold spells during the winter, cannot be considered as an incorrect one; on the contrary, it brings to the attention of the operating people the possible necessity of adding oil to the transformers.

"Undesirable trippings have occurred in some infrequent cases due to oil repercussions during severe (through) faults. These cases should, however, be extremely rare because of the improved relay design. It should not be overlooked that a periodic inspection of the relay will help to prevent incorrect operations as may be caused by clogging of the oil or leaks in the floats.

"Through the application of Buchholz relays, it has so far not been possible to obtain a reduction of the premiums charged by the insurance companies. However, in case of damage, they have come to an understanding to this extent, that that share of the damage which the insured normally should pay for, has been reduced or completely waived. The negotiations with the insurance companies are being continued.

"The favorable relations with the insurance companies can be attributed to the fact that due to the application of the Buchholz relay, the extent of the damage is smaller than by application of other means of protection."

* * *

6

"There is a similar relay which is called 'Bendmann Protection' and which can be applied to transformers not equipped with conservators. This relay is described in the 'Elektrotechnische Zeitschrift' (ETZ) of February 25, 1937, page 217. Our company has no experience with this type of protection."

* * *

7

"The application of Buchholz Protection on transformers without oil conservators has caused difficulties. The tests with the relay models especially designed for this purpose have not given entirely satisfactory results. Gases generated very slowly are known to have passed by the relay.

"The licensed company in this country has from time to time employed a different arrangement on transformers of some thousand kv-a whereby a baffle plate of insulating material was placed on an angle below the oil level. This plate had to have the necessary openings for bushings. A corresponding seal was placed between this plate and the transformer tank. The relay was connected at the highest point of this baffle plate. The oil had to be sucked up by means of a pump. Less than normal pressure exists in the relay as long as oil remains in it. Actual (practical) tests are supposed to have proved the efficacy of this arrangement."

* * *

8

"According to our knowledge Buchholz relays have functioned on unfaulted transformers only if the respective transformers had to be assembled on site and were, therefore, not properly evacuated. The test with a burning match is giving quick and reliable information as to the nature of the collected gas."

* * *

9

"Apparently the only disadvantage is where a pump for oil circulation is applied to a transformer. In this case we have experienced that aside from the fact that the pump may draw air inside the transformer there may be an alarm or a tripping at the starting or at the stopping of the pump due to the elasticity of tank and other cooling parts."

Descriptive Bulletins

Several of the correspondents submitted bulletins and descriptive data which may be of interest and which, no doubt, can be obtained by writing to the companies or persons indicated.

1. "Operating Experience with the Buchholz Protective Device for Transformers."
This is a booklet describing the relay and giving the performance record of the relay in 97 cases of fault, the case history of 63 of which is given in detail. This booklet has been prepared by:

Max Buchholz
Amalienstrasse 1
Kassel, Germany

2. "Fundamental Principles Underlying the Problem of the Protection of Generators and Transformers," by H. Puppikofer
"Bulletin Oerlikon" No. 105/6—March/April 1930
This article gives a brief description and

application of the Buchholz relay as furnished by the Swiss Licensee

Ateliers de Construction Oerlikon
Oerlikon, Switzerland

3. Bulletin TRO/V 1047 b—Buchholz-Schutz briefly describing the Buchholz Relay and Bulletin TRO/V 1258—Buchholz-Schauglas describing a simplified version in which a visible indication only is given at the top of the transformer upon the accumulation of gas.

Allgemeine Elektricitats Gesellschaft
Berlin, Germany

4. The Hackbridge Transformer Protective Relay.

A bulletin describing an English version of the relay in which the oil level in the gas accumulation chamber of the relay is remotely indicated by introducing the plates of a condenser into the chamber instead of the Buchholz float. This condenser forms part of the circuit of a local vacuum tube oscillator, so arranged that the change in oil level changes the capacity of the condenser (by substituting gas for oil as the dielectric medium) and thus changes the oscillator's output which is read on a meter located in the station.

An auxiliary device operated by sudden pressure in the conservator pipe is arranged to trip the transformer by so changing the capacity of the condenser as to cause a relay in the output circuit of the oscillator to operate.

The Hackbridge Electric Construction Co., Ltd.
Walton-on-Thames, England

Changes in Standard Ratings of Oil Circuit Breakers

THE EEI-AEIC-NEMA Joint Committee on Oil Circuit Breakers on March 16 gave unanimous approval to the following proposed modification of the standard Interrupting Ratings for outdoor oil circuit breakers in the Schedule of Preferred Ratings* approved by this Committee in 1934.

Voltage Rating	Original Standard Rating (Kva) Now Eliminated	Approved Standard Rating (Kva)
15,000	175,000	250,000
23,000	150,000	250,000
34,500	150,000	250,000
46,000	150,000	250,000

The manufacturers' representatives in presenting this proposed change assured the committee that the elimination of the 150,000 kv-a interrupting ratings would not result in an increase in the price of breakers in the 23 kv, 34.5 kv and 46 kv classes and that the increase in price for the 250,000 kv-a breaker in the 15,000 volt class would not exceed 12 or 14%. This means, of course, that a substantial increase in kv-a interrupting capacity will be obtained with little or no increase in the cost of circuit breakers.

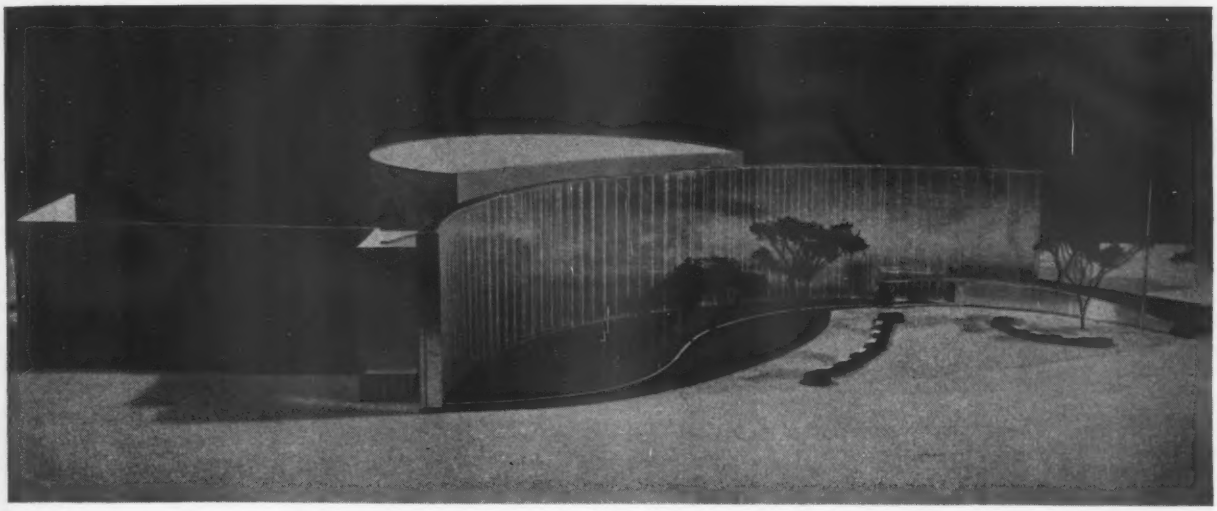
*Published in January 1935 EEI Bulletin.

FARM SERVICE—AS OF DECEMBER 31, 1937

NUMBER AND PERCENTAGE OF FARMS RECEIVING ELECTRIC SERVICE

State	Total all Occupied Farms* (A)	Farms with Dwellings Valued Under $500** (B)	Farms with Dwellings Valued Over $500 (C)	Farms Receiving Electric Service (D)	Percentage Electrified D/A (E)	Percentage Electrified D/C (F)
United States	**6,422,088**	**2,093,996**	**4,328,092**	**1,241,505**	**19.3**	**28.7**
Maine	40,092	4,609	35,483	16,765	41.8	47.2
New Hampshire	17,147	871	16,276	9,718	56.7	59.7
Vermont	25,741	1,768	23,973	7,572	29.4	31.6
Massachusetts	33,092	611	32,481	21,359	64.5	65.8
Rhode Island	4,078	81	3,997	3,860	94.7	96.6
Connecticut	29,508	352	29,156	20,000	67.8	68.6
New England	149,658	8,292	141,366	79,274	53.0	56.1
New York	168,269	6,175	162,094	87,787	52.2	54.2
New Jersey	28,818	462	28,356	19,722	68.4	69.6
Pennsylvania	186,127	9,459	176,668	84,636	45.5	47.9
Middle Atlantic	383,214	16,096	367,118	192,145	50.1	52.3
Ohio	244,451	20,608	223,843	92,595	37.9	41.4
Indiana	193,461	22,657	170,804	51,582	26.7	30.2
Illinois	225,093	21,036	204,057	51,865	23.0	25.4
Michigan	188,827	16,111	172,716	84,031	44.5	48.7
Wisconsin	194,765	14,091	180,674	60,477	31.1	33.5
East North Central	1,046,597	94,503	952,094	340,550	32.5	35.8
Minnesota	196,621	18,864	177,757	17,980	9.1	10.1
Iowa	214,484	7,317	207,167	39,651	18.5	19.1
Missouri	267,176	63,887	203,289	25,860	9.7	12.7
North Dakota	77,193	10,977	66,216	3,277	4.2	4.9
South Dakota	78,359	13,684	64,675	3,321	4.3	5.1
Nebraska	128,814	10,614	118,200	12,583	9.8	10.6
Kansas	162,992	24,093	138,899	17,787	10.9	12.8
West North Central	1,125,639	149,436	976,203	120,459	10.7	12.3
Delaware	10,134	697	9,437	2,788	27.5	29.5
Maryland—Dist. of Columbia	42,990	5,069	37,921	16,666	38.8	43.9
Virginia	186,892	54,929	131,963	22,986	12.3	17.4
West Virginia	100,409	28,753	71,656	10,629	10.6	14.8
North Carolina	280,716	125,697	155,019	32,192	11.5	20.8
South Carolina	154,720	96,683	58,037	14,171	9.2	24.4
Georgia	236,501	151,257	85,244	16,521	7.0	19.4
Florida	59,726	23,900	35,826	7,589	12.7	21.2
South Atlantic	1,072,088	486,985	585,103	123,542	11.5	21.1
Kentucky	257,845	123,819	134,026	13,603	5.3	10.1
Tennessee	250,192	127,179	123,013	25,079	10.0	20.4
Alabama	258,227	171,466	86,761	20,938	8.1	24.1
Mississippi	292,112	216,307	75,805	7,012	2.4	9.3
East South Central	1,058,376	638,771	419,605	66,632	6.3	15.9
Arkansas	240,139	157,894	82,245	7,559	3.1	9.2
Louisiana	162,978	107,744	55,234	8,008	4.9	14.5
Oklahoma	200,951	100,251	100,700	12,772	6.4	12.7
Texas	458,622	203,572	255,050	31,205	6.8	12.2
West South Central	1,062,690	569,461	493,229	59,544	5.6	12.1
Montana	46,150	18,712	27,438	4,582	9.9	16.7
Idaho	41,919	11,140	30,779	20,109	48.0	65.3
Wyoming	16,484	6,189	10,295	1,993	12.1	19.4
Colorado	59,065	18,050	41,015	9,625	16.3	23.5
New Mexico	38,059	17,978	20,081	2,100	5.5	10.5
Arizona	17,681	5,081	12,600	6,890	39.0	54.7
Utah	26,203	4,861	21,342	19,369	73.9	90.8
Nevada	3,365	850	2,515	1,276	37.9	50.7
Mountain	248,926	82,861	166,065	65,944	26.5	39.7
Washington	81,105	15,347	65,758	47,045	58.0	71.5
Oregon	61,137	12,003	49,134	29,016	47.5	59.1
California	132,658	20,241	112,417	117,354	88.5	104.4
Pacific	274,900	47,591	227,309	193,415	70.4	85.1

* 1935 Census—Agriculture.
** 1930 Census—Agriculture.



Model of the New York World's Fair Building of Consolidated Edison Company, Inc.

Construction Of Consolidated Edison World's Fair Building Is Started

CONSOLIDATED EDISON COMPANY of New York, Inc., and affiliated companies inaugurated construction of its building for the New York World's Fair of 1939 with appropriate ceremonies at the Fair Grounds in Flushing at noon on March 10, 1938. More than one hundred men including the Board of Trustees of the Edison Electric Institute, were welcomed by Grover Whalen, President of the Fair, heard brief dedicatory remarks by Floyd L. Carlisle, President of Consolidated Edison Company of New York and also a member of the Fair's Executive and Finance Committees and Board of Governors, and George McAneny, Chairman of the Fair's Board of Directors. The gathering then witnessed the driving of the first of the mammoth piles, 90 feet in length, upon which foundations for the building will rest.

Mr. Whalen eulogized Mr. Carlisle for his part in the development of the Fair, and expressed appreciation for his vision and energy as a member of the Fair's Committees and Board. Mr. McAneny emphasized the tremendous part that light will play in the Fair. New lighting effects of many kinds will be used to dramatize the architectural beauty of the buildings and to educate the public in new possibilities in the lighting field.

"Consolidated Edison is very glad indeed to participate in the New York Fair," Mr. Carlisle said, "as its significance is not only municipal and national but world-wide in its importance to mankind.

"The purpose of the exhibit we will make in our building is to identify the services of Consolidated Edison with the life of the people of this great city. Our services enter into every phase of that life. We intend to make a dramatic representation of the integral part in the industrial and social life of New York played by Consolidated Edison."

Following the outdoor ceremonies, the guests were entertained at luncheon in the Administration Building. Speak-

Mr. Carlisle at the controls of the monster pile driver which drove the 90-ft. piles for the foundation of the building—Mr. Whalen is standing by

ers were Mr. Whalen, Mr. Carlisle, Gene Buck, noted composer, and Olin Downes, music critic of the New York *Times*.

In reporting progress to the gathering Mr. Whalen said that upwards of 300 exhibitors had pledged participation in the fair, exhibitors including about 200 business and industrial organizations, thirty-two States, two territories, sixty-four nations and the League of Nations. A total of $150,000,000 would be invested in the fair, he said. Each of the speakers told those present that the fair provided U. S. business an unparalleled opportunity for placing the story of its accomplishments before the world. The "World of Tomorrow" will be fashioned, they suggested, along the lines pursued and projected today.

The Fair will be open for 160 days, and will be able to handle a million visitors a day. A preview of the Fair is now being arranged for April 30 of this year, so that the public may gain at this time a conception of what the completed Fair will offer a year from now.

The Consolidated Edison building is being erected upon a plot of 75,183 square feet in the Means of Production Zone on an avenue leading from the Theme Center to the New York State amphitheatre.

The architects of the building are Harrison & Fouilhoux, who designed the Perisphere and Trylon, the dominant architectural group of the exposition. Exhibits in the structure have been designed by Walter Dorwin Teague.

The central portion of the structure, directly back of the centre of the glass-enclosed fountain, will be known as "Panorama Hall." It is to be a semi-circular chamber 125 feet wide, with a 50-foot ceiling, capable of accommodating 800 visitors. In it will be displayed a great two-dimensional model of New York from Yonkers to Coney Island, designed to tell the whole story of Consolidated Edison service in electricity, gas and steam. The power stations of the organization, its gas containers and steam plants are to be shown.

In the extreme left wing of the building will be the apparatus which air-conditions the entire structure, various other needed mechanisms and electrical contrivances of latest pattern, and an information booth for public convenience. On the second floor provision has been made for general offices and a private lounge.

Among the guests at the luncheon, held after the dedication ceremonies, were: C. W. Appleton, Hugh Cuthrell, Joseph P. Day, Harold C. Dean, William L. Diehl, Louis K. Egan, Roy K. Ferguson, W. S. Finlay, Jr., Alexander Forward, O. H. Fogg, P. H. Gadsden, William J. Hagenah, W. P. Holcombe, George H. Howard, J. F. Hunter, G. Clayton Irwin, E. F. Jeffe, D. C. Johnson, C. W. Kellogg, William Kelly, A. H. Kehoe, G. L. Knight, Clarence L. Law, H. P. Liversidge, J. F. MacLane, George V. McLaughlin, A. C. Marshall, George C. Meyer, Robert Moses, W. Cullen Morris, Preston S. Millar, F. H. Nickerson, James H. Perkins, W. H. Sammis, A. H. Schoellkopf, E. H. Sniffin, C. E. Stephens, John Stilwell, R. H. Tapscott, C. A. Tattersall, T. H. Taylor, Edmund W. Wakelee, Bernard F. Weadock and Stuart Wilder.

RESIDENTIAL ELECTRIC SERVICE AND COST OF LIVING

Index Numbers—1913 = 100

Year	Average Annual Use Kwhr	Average Annual Bill	Average Revenue Per Kwhr	Cost of Living (a)	Residential Electric Service
December 1937	**793**	**$34.81**	**4.39c**	**148.2(b)**	**50.5**
December 1936	727	33.81	4.65	143.6(c)	53.4
December 1935	672	33.53	4.99	141.7(d)	57.4
December 1934	624	33.07	5.30	137.8(e)	60.9
December 1933	595	32.56	5.49	134.6	63.1
December 1932	597	33.25	5.57	133.5	64.0
December 1931	578	33.18	5.74	148.3	66.0
December 1930	543	32.58	6.00	163.6	69.0
December 1929	499	31.44	6.30	173.7	72.4
December 1928	460	30.36	6.60	173.2	75.9
December 1927	444	30.19	6.80	175.0	78.2
December 1926	428	29.87	6.98	178.3	80.2
December 1925	398	28.90	7.30	181.3	83.9
December 1924	378	27.25	7.20	174.3	82.8
December 1923	368	26.50	7.20	174.7	82.8
December 1922	359	26.50	7.38	170.3	84.8
December 1921	347	25.65	7.39	174.9	84.9
December 1920	339	25.25	7.45	195.6	85.6
December 1919	293	22.55	7.70	191.4	88.5
December 1918	272	22.50	8.27	166.9	95.1
December 1917	268	20.15	7.52	138.3	86.4
December 1916	265	20.15	7.60	116.6	87.4
December 1915	260	20.80	8.00	104.7	92.0
December 1914	268	22.25	8.30	102.7	95.4
December 1913	264	22.97	8.70	100.0	100.0

a—U. S. Bureau of Labor Statistics.
b—September 15, 1937.
c—December 15, 1936.
d—January 15, 1936.
e—November 15, 1934.

U. S. Tax Collections as Compared with Cost of Residential Electric Service

	Calendar Year 1936	*Calendar Year 1937*
Residential Electricity	$696,997,400	$740,100,000
Liquor Taxes	569,081,880	587,305,610
Tobacco Taxes	536,102,851	563,183,593
Total taxes	$1,105,184,731	$1,150,489,203

Federal liquor and tobacco taxes alone are half again as much as total cost of residential electric service.

Federal Gasoline Taxes	$186,541,996	$203,025,380
Other Federal Taxes on Auto Equipment	111,509,766	123,241,467
Total	$298,051,762	$326,266,847

Federal taxes on automotive equipment and gasoline alone come to almost half of the total cost of residential electric service.

Source: *Electricity:* EEI "Supplement to Statistical Bulletin #4" and *Taxes:* News Release of Treasury Department, February 8, 1938.

To Help You— In Your Sales Programs

ATTENTION has been focused many times in these columns on the material available in connection with national promotional programs in which the Institute is a co-sponsor. But the extent and value of this material to utility companies and others that can use it is seldom realized. The accompanying illustrations visualize a part of it.

The Executive Committee for these cooperative programs produces in conjunction with the particular advertising agency chosen for the job, scores of items from outdoor posters to bill enclosures. The commercial staff of the Institute aids in productions and undertakes the management of these programs.

The scope of application of the service represented through the electrical equipment promoted naturally determines the extent of distribution. For example, Better Light-Better Sight material is being used in every State in the country and in some foreign properties. Lighting covers every classification of our business. It extends into the schools and the lighting of highways. The Modern Kitchen Bureau is somewhat more restricted, but its Kitchen Planning phases are universally applicable and the promotional pieces for product development will expand widely its usefulness. On the other hand the activities of the Electric Water Systems Council and of the Commercial Electric Cooking Council deal with special classifications.

The amount of material of the type pictured on these pages, produced and distributed in just these four national activities exceeds between four and five million pieces. This total includes approximately 500,000 copies of *Better Light-Better Sight News* and 1,500,000 educational type booklets and folders in connection with this program; 250,000 of the electric range booklets *Meals Go Modern* and 500,000 booklets on the Electric Kitchen. Also approximately 500,000 *Life in the Country* booklets and 250,000 broadsides for mailing pieces used in different programs.

There have been more than 100,000 Plan Books produced and distributed. Approximately 700 combination films and records of sound-slide type have been produced under four captions. Reprints of advertisements and write-ups bearing on these promotions total around 350,000.

Supplementing these major items are 100,000 upwards of other items such as playlets, lectures, radio continuities, newspaper releases, window panels and the like. There are around 100 items from which to choose. In conjunction with this promotion the cooperating manufacturers have distributed millions

of promotional pieces tying in with the theme of the activity.

It is of interest that the sixth edition of the *Handbook of Interior Wiring Design* is just off the press. There have already been 37,000 copies distributed through the Institute and this edition of 10,000 copies will be distributed in the next few months.

All the foregoing items are additional to the Reports for the regular organizational committees which are subsidiary to the General Sales Committee. Among this group attention is called especially to the Plan Book on Store Lighting with suggestion for promoting this important classification of service; also to *Trends in School Lighting* which is a helpful reference for those who are seeking information on the need of new standards in illumination for modern schools.

Demand rapidly increased for *Rural Electrification Exchange,* a publication of the Rural Sales Committee, originally released in mimeographed form. It is now published in magazine form with letter-press printing and cover. A subscription fee of 50c. per year is made for four quarterly issues.

Help Children See Better
FOR THE FIRST TIME
HYGEIA
Better Light Better Sight NEWS
Seeing Begins
Children's Sight and School Lighting
OLD EYES in YOUNG PEOPLE
8 Better Light—Better Sight Displays
A Series of
HOME AND SCHOOL LIGHTING
9 Lamps out of 10 ROBERTSON BEAMS EYESTRAIN
SEEING
...A GUIDE TO THE BEST USE AND CARE OF THE EYES...
EDUCATION and LIGHT
Are You Interested in Conserving Your
EYESIGHT
LIGHT through the Ages
2nd Anniversary
I. E. S. BETTER SIGHT LAMP DISPLAY POSTER
The I.E.S BETTER SIGHT LAMP
Only One Pair of Eyes
BETTER VISION INSTITUTE BULLETIN
I.E.S. Lamps
R-VISION WEEK—FEB. 20TH TO FEB. 27TH
...ON THE CAUSE OF EYESIGHT CONSERVATION
Conservation of School Children's Eyes
DR. A. C. SNELL
★BETTER SIGHT PICTORIAL★
Published in the interest of Better Seeing
HOW TO SELL THE NEW I.E.S STUDY AND READING LAMP
WHAT LIGHT for the EYES?
Light in the HOME
Save that Twinkle!
Glorified Light
LIGHTS! CAMERA! ACTION!
Good Eyes—Good Pupils
Visual Problems in Education
NEW KNOWLEDGE of SEEI IN THE CLASSROOM

I KISSED A
$400 in CASH PRIZES
THE GHOSTS GO WEST
A DRAMA OF NEW ELECTRIC LOAD
PRESENTED BY MODERN KITCHEN BUREAU
MEALS GO MODERN Electrically
The Modern Kitchen Bureau 1938 PLAN to help you sell
SPECIAL ELECTRIC RANGE EDITION
GIVES HOUSEWIVES
N ELECTRIC RANGES
New 1938 Ranges Give Fast, Clean, Low-Cost Cooking
Post this on your BULLETIN BOARD
IDEAS that have worked in LOCAL PROMOTIONS
An Electric Kitchen IS A
MY KITCHEN WAS Haunted
LET'S TALK about ELECTRIC KITCHENS
Save money with a (BRAND NAME) ELECTRIC RANGE
$3,000 in CASH PRIZES
For a Healthy Family A WHOLESOME KITCHEN
See the new Electric Ranges today...
Haunted
SPOOKS
WE SHADOWED A Star SALESMAN
... TO FIND OUT HOW HE SELLS SO MANY Electric REFRIGERATORS
ADIO SPOT ANNOUNCEMENTS
RIC RANGE TIE-IN NEWSPAPER ADVERTISEMENTS
(FOR BUREAU OR UTILITY USE)
Showing of NEW 1938 TRIC RANGES
Got the thrill of a Lifetime!
See the NEW 1938
Spring Showing OF ELECTRIC RANGES!

Characteristics and Sag and Tension Calculations of Aluminum Cable Steel Reinforced

By H. H. Rodee
Aluminum Company of America

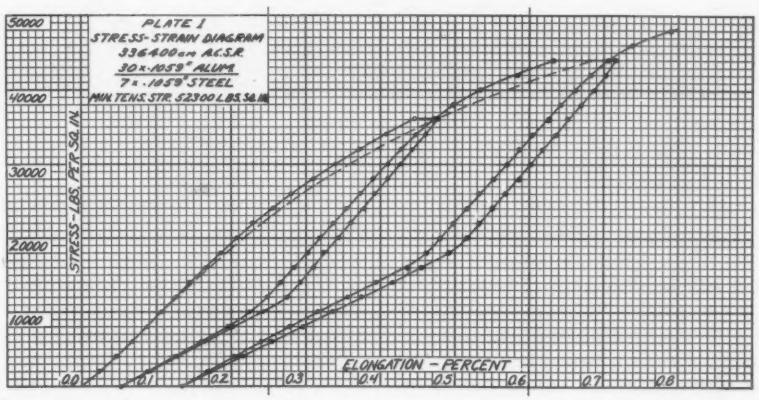
A paper presented before a meeting of the Transmission and Distribution Committee E.E.I., Louisville, Ky., Feb. 9-10, 1938

MANY of you will remember the paper presented by Mr. M. E. Noyes in St. Louis, February 16, 1931, before the Distribution Section of the Overhead Systems Committee of the former N.E.L.A. on the subject, "Mechanical Behavior of Overhead Conductors Under Change of Stress." This paper will, in many respects, be a continuation of that discussion with particular reference to A.C.S.R. and taking into account change in temperature in the calculation of sags and tensions.

I also wish to refer to the booklet entitled "A.C.S.R. Graphic Method for Sag-Tension Calculations," published by the Aluminum Company of America in 1927. Although this method is familiar to many of you, a more detailed discussion of some features may be of interest.

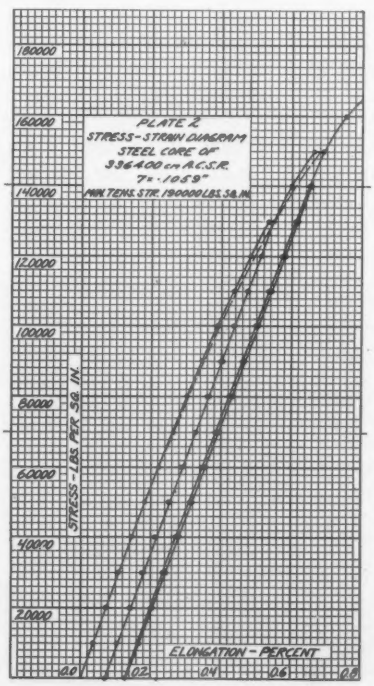
A.C.S.R. is composed of a high strength galvanized steel core surrounded by an envelope of hard drawn aluminum wires. The steel may be solid or stranded, and the aluminum may be arranged in one or more layers depending on the size of conductor and proportions of steel and aluminum. One feature of A.C.S.R. that is often helpful in transmission line design is the ease with which the relation between strength, weight, diameter and carrying capacity may be altered to suit different conditions by varying the proportions of aluminum and steel. For conductors commonly used on overhead lines the proportion of steel is usually between 11.5% and 20.25% of the total cross-sectional area. The corresponding proportions of steel by weight are between 26.7% and 42.2%. For special applications, however, such as long span river crossings requiring large clearance and flat sag, conductors are frequently made with the steel core providing as much as 60% of the total cross-sectional area.

Mechanical and electrical characteristics of A.C.S.R. conductors and the specifications on which they are based are given in the Aluminum Company of America's published tables and data.



I will, therefore, confine this discussion principally to the subject of sags and tensions under varying weather conditions.

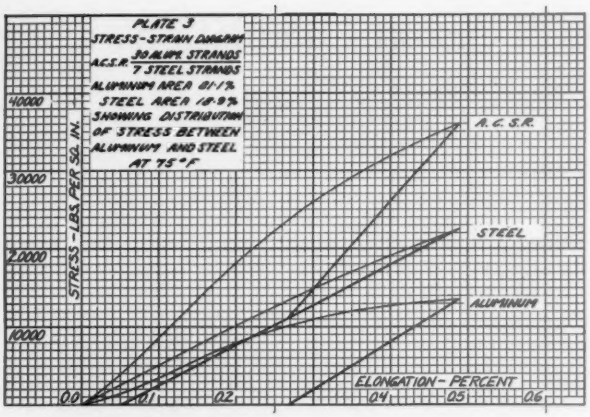
A transmission line conductor is subjected to a very wide range of tension. The minimum may be only 10% or 15% of the ultimate strength while the maximum may be 50%, 60%, or even 70%. The temperature may vary from as low as —40°F to plus 120°F or even higher. Since aluminum and steel respond quite differently to changes of stress and temperature, the behavior of the two metals is treated independently in computing sags and tensions for A.C.S.R.

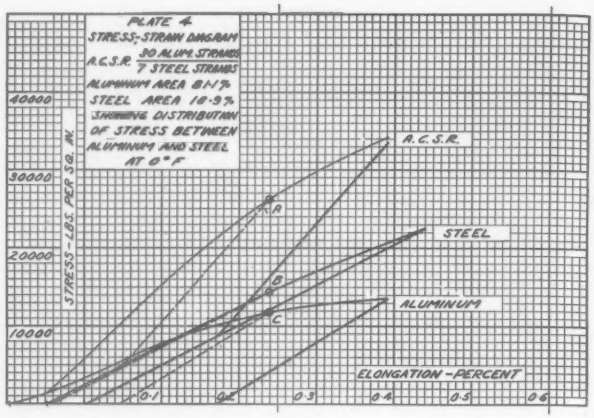


The behavior of a conductor under change of stress is most graphically shown by a stress-strain diagram obtained from actual test in which strain (that is, elongation or extension from original length) is measured for numerous values of tensile stress.

In our work, tests of this kind are made on an Amsler horizontal cable testing machine having four capacity ranges from 10,000 to 100,000 pounds. The ends of the test sample are held by compression grips and the gauge length is usually 500 inches. To eliminate sag and to insure straightness of the cable at zero stress the test sample is suitably supported in a trough throughout the entire gauge length. The apparatus used in obtaining extension measurements consists of telescopes mounted above steel scales fastened to the cable at each end of the gauge length.

Plate 1 shows a stress-strain diagram of 336,400 cm A.C.S.R. composed of 30 Aluminum Strands and 7 Steel Strands. The plotted points are shown to illustrate the refinement of test



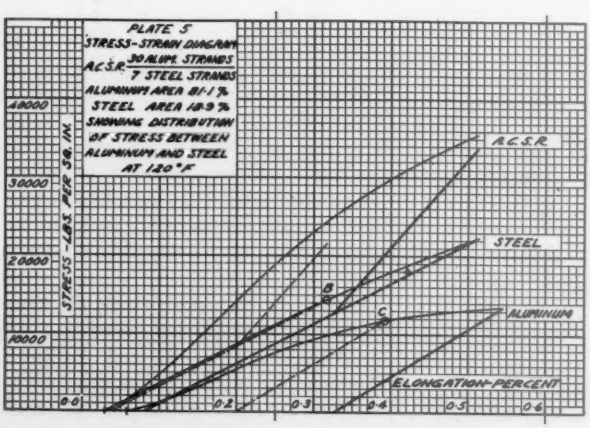


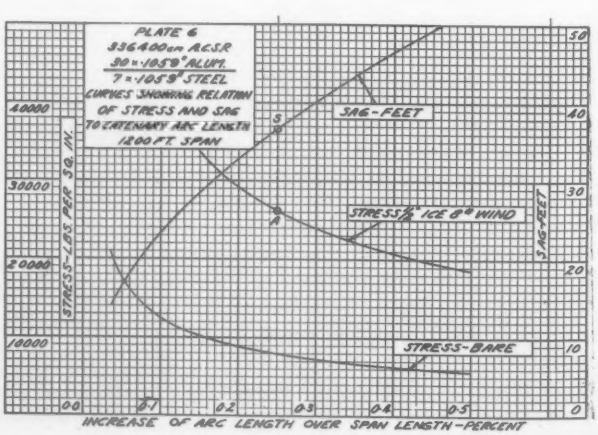
method. The hollow circles show readings for ascending loads and the solid circles for descending loads. In this test the stress was increased by steps to 70% of the ultimate strength and held at this value for 1 hour, then decreased back to 0 and stepped up again to 84% of the ultimate strength and held for 3½ hours, then decreased back to 0 and stepped up again to a still higher value. It will be observed that the stress-strain diagram for initial loading is a curved line throughout the upper range of stress and for subsequent loading is essentially two straight lines in series, the slope being much steeper throughout the higher range of stress than throughout the lower range. The significance of this is that below the point where the slope changes, the aluminum is without stress, and the entire load is carried by the steel core. Had the load been dropped back from any other value the final diagram would be similar in shape and parallel to those obtained by dropping back from 70% to 84%. The dotted line is the practical stress-strain diagram which would have been obtained after holding loads one hour, had the intermediate loads been held instead of concentrating the holding time at 70% and 84% only.

Plate 2 shows a similar stress-strain diagram of the steel core of 336,400 cm A.C.S.R., i.e., seven strands of .1059" diameter steel. Note that the scales have twice the value as on the preceding plate, merely to avoid an extremely large chart. A large number of tests of this character have been made. embracing the complete range of standard sizes of A.C.S.R., and their steel cores, as well as tests on many special types of stranding. From these tests, stress-strain diagrams have been prepared for use in calculating sags and tensions graphically. In this work the same stress-strain diagram is used for certain groups of conductor sizes of the same stranding, that is, conductors having the same proportions of aluminum and steel.

Plate 3 shows the stress-strain diagram as prepared for this purpose for conductors composed of 30 Aluminum Strands and 7 Steel Strands. This diagram is, in reality, three separate diagrams, one for A.C.S.R., one for steel and one for aluminum. The A.C.S.R. diagram is obtained from tests as shown on Plate 1. The steel diagram is obtained from tests as shown on Plate 2 but the values of stress as plotted are in proportion to the percentage of steel cross-sectional area, in this case 18.9%. That is, the stress values as plotted are 18.9% of the values recorded in the test. The final diagrams have been drawn as single lines representing the average of the diagrams obtained on ascending and descending loads. The steel diagram drawn in this fashion represents the proportion of total cable stress that is carried by the steel core. The diagram for the aluminum is then obtained as the difference between the diagrams for A.C.S.R. and steel and represents the proportion of total stress carried by the aluminum. We now have a diagram which shows the stress-strain behavior of A.C.S.R., the independent behavior of the steel and aluminum parts of the cable and dstribution of stress between aluminum and steel at the temperature of test which in this case was 75°F.

Now as the temperature changes there will be a change in distribution of stress between aluminum and steel since aluminum contracts or expands





twice as much as steel for the same temperature change. The thermal coefficient of expansion of aluminum is .0000128 and of steel .0000064 per degree F.

Plate 4 shows the stress-strain diagram reassembled to represent conditions at 0°F. This is obtained by drawing the independent diagrams for aluminum and steel as shown on Plate 3 with their origins shifted to the left, on the elongation-percent scale, a distance corresponding to the change in length of the respective metals due to a drop in temperature from 75° to 0°F. The steel and aluminum diagrams are then added together in this position to obtain the A.C.S.R. diagram at 0°F. I wish to call to your attention that the final stress-strain diagrams shown on this chart represent conditions at 0°F after the cable has been loaded at 75°F. The dotted lines drawn from points A, B, and C, parallel to the final diagrams for A.C.S.R., steel and aluminum respectively are the final diagrams after the conductor has been stressed to fifty per cent of its ultimate strength (26,150 pounds per sq. in.) at 0°F. These dotted lines will be referred to on a later plate to illustrate a typical problem.

Plate 5 shows the stress-strain diagram reassembled in a similar fashion to represent conditions at 120°F. In this case the original steel and aluminum diagrams have been shifted to the right on the elongation-percent scale a distance corresponding to a rise in temperature from 75°F to 120°F. The dotted lines drawn from points B and C are the same as shown on the zero degree diagram and when added together in this position the result is the final diagram for A.C.S.R., at 120° after having been stressed to 50% of its ultimate strength at 0°F. The stress-strain diagrams may be reassembled in a similar manner to represent conditions at any desired temperature.

The curves on Plate 6 show the relation of stress and sag to catenary arc length for 336,400 cm A.C.S.R., composed of 30 Aluminum Strands and 7 Steel Strands in a 1200 foot span. These curves are derived from the catenary formula and are readily calculated from the tables of catenary constant given in "A.C.S.R. Graphic Method for Sag-Tension Calculations." Arc length is expressed without appreciable error as percent increase of arc length over span length. The percent scale and stress scale are the same in value as used on the stress-strain diagrams. Stress curves are shown for bare conductor and for conductor loaded with ½" ice and 8 pounds wind and similar curves may be added for any desired loading assumption. There is also a curve showing relation of sag to arc length.

To illustrate a typical problem let us assume a maximum tension of 50% of the ultimate strength of the conductor under a maximum load of ½" ice, 8 pounds wind at 0°F. The stress, 26,150 pounds per square inch, under maximum loading is shown at A and directly above this on the sag curve at point S we read the loaded sag in the plane of the resultant as 36.7'.

Now please imagine that the stress-strain diagram at different temperatures are on transparent sheets and that the diagram at 0° is laid over this chart so that the base lines are coincident and so that the initial stress-strain curve intersects the maximum loading curve at point A.

Plate 7 shows the two charts as they will now appear. We now have a diagram which satisfies the laws of the catenary, the tensile behavior of the conductor at 0° and the assumptions of maximum load. We read the initial stringing tension at A' as 13,200 pounds per sq inch, being the intersection of the initial stress-strain curve with the stress curve for bare conductor. Directly above on the sag curve at point S' we read the corresponding sag as 22 feet. Now let maximum load come on and the stress will increase to 26,150 pounds per sq inch at point A. When the load evaporates from the line the conductor contracts along the final stress-strain diagram shown as the dotted line drawn from point A. The final tension is read at A" as 11,400 pounds per sq inch and the sag directly above at S" as 25.4'. Stresses in aluminum and steel may be obtained if desired from the appropriate curves vertically below points A, A', and A". These points have not been indicated to avoid complicating the chart.

With the stress-strain diagram at 0° in this position a reference point R is marked on the catenary chart to indicate the relative position of the elongation-percent scale of the stress-strain diagram with respect to the arc length scale of the catenary chart. Now let us remove the stress-strain diagram at 0° and put the stress-strain diagram at 120° in its place so that its percent scale is in the same relative position with respect to the arc length scale. The diagram will then appear as shown on Plate 8. The initial stringing tension at 120°F is now read at P' as 9750 pounds per sq inch being the intersection of the catenary stress curve for bare cable with the initial stress-strain curve. The corresponding sag is read directly above at T' as 29.8'. The final tension after maximum loading is read at P as 8600 pounds per sq inch and the corresponding sag at T as 33.9 feet.

Sags and tensions at any other tem-

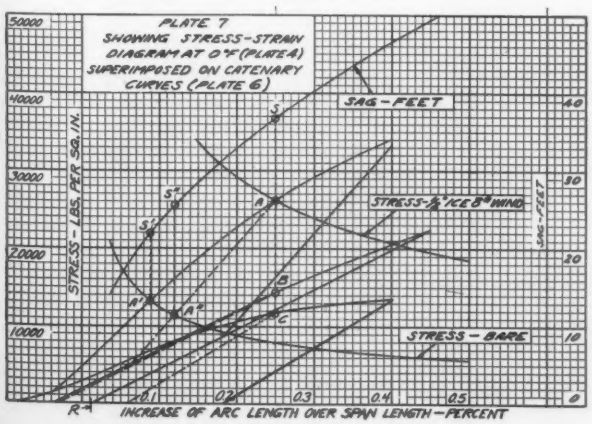


PLATE 7
SHOWING STRESS-STRAIN DIAGRAM AT 0°F (PLATE 4) SUPERIMPOSED ON CATENARY CURVES (PLATE 6)
SAG-FEET
STRESS-½" ICE 8# WIND
STRESS-BARE
STRESS-LBS. PER SQ. IN.
INCREASE OF ARC LENGTH OVER SPAN LENGTH-PERCENT

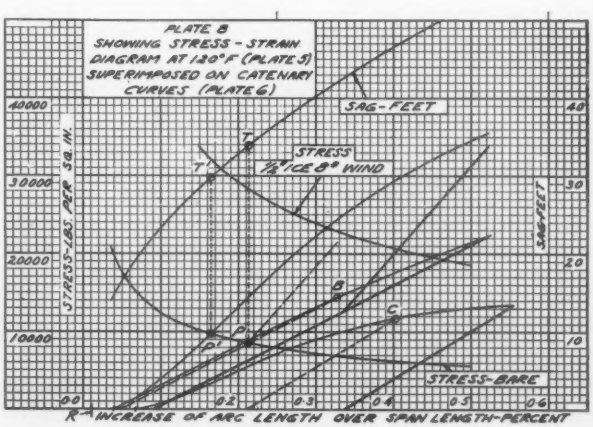
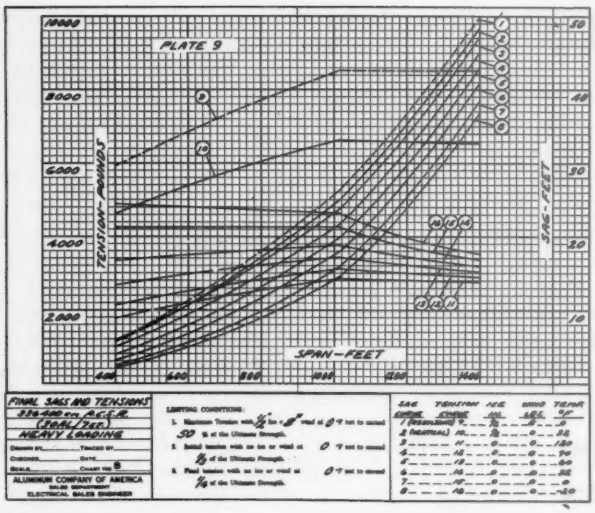
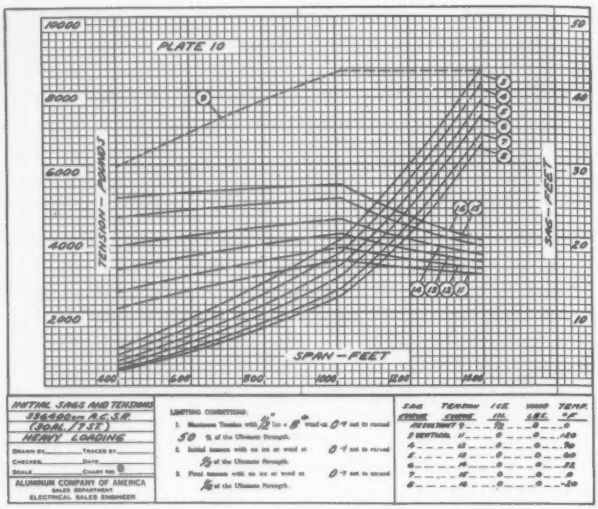


PLATE 8
SHOWING STRESS-STRAIN DIAGRAM AT 120°F (PLATE 5) SUPERIMPOSED ON CATENARY CURVES (PLATE 6)
SAG-FEET
STRESS ½" ICE 8# WIND
STRESS-BARE
STRESS-LBS. PER SQ. IN.
INCREASE OF ARC LENGTH OVER SPAN LENGTH-PERCENT





perature may be determined in a similar manner by using a stress-strain diagram reassembled to represent conditions at that temperature.

For any other span length this same procedure is repeated. That is, curves are drawn to show the relation of stress and sag to catenary arc length and the stress-strain diagrams are superimposed in the manner just described.

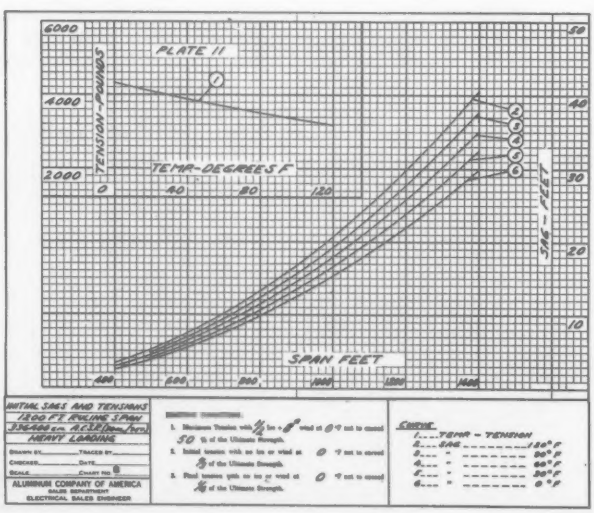
Let us consider for a moment the practical limits of conductor tensions. The maximum tension under the assumed maximum loading is usually limited by governmental regulations or construction standards to some specified value such as 50% or 60% of the ultimate strength. The use of this limitation alone will under certain conditions result in an unloaded tension in excess of that considered suitable for normal every-day operation. To take care of this situation it is desirable to place a maximum limit on the normal every-day tension. The limits adopted by the Aluminum Company of America several years ago as a basis for calculating sags and tensions are that the initial tension without ice or wind shall not exceed one-third of the ultimate strength and the final tension without ice or wind shall not exceed one-fourth of the ultimate strength. Under heavy loading conditions these limits are applied at 0°F, under medium loading conditions at 15°F and under light loading conditions at 30°F, these being the temperatures at which maximum loading is assumed to occur in the three loading districts. The maximum loaded tension will, of course, be reduced in spans where these unloaded tension limits control.

Plate 9 shows final sags and tensions in spans from 400 feet to 1400 feet for 336,400 cm A.C.S.R. (30 A1/7 St) based on a maximum tension of 50% of the ultimate strength occurring at 0°F with ½" ice and 8 pounds wind. This chart is obtained by making calculations like those just described for a sufficient number of span lengths to secure smooth curves. In spans less than 1015 feet in length the final tension without ice or wind at 0°F (curve 15) is the governing limit. This type of chart is used principally for design purposes, that is, for establishing ground clearance and height of structures and for making sag templates based on specific ruling spans for use in spotting structures on a plotted profile. It may also be used for stringing prestretched conductors on dead end spans or for making stringing charts based on specific ruling spans.

Plate 10 shows initial sags and tensions corresponding to the final curves shown on Plate 9. This type of chart is used as a basis for making stringing charts for specific ruling spans and for sagging conductors that have not been prestretched on dead end spans. It is also used as a basis for making sag templates for investigating uplift conditions on a plotted profile.

Plate 11 shows initial stringing sags and tensions based on a 1200 foot ruling span and is made from the initial sag and tension chart just shown on Plate 10. This type of chart is used for sagging conductors during construction on a series of spans of different lengths. It might also be called a "Ruling Span" chart or "Constant Tension" chart since

(*Continued on page* 104)



A Formula as an Aid in Vehicle Accident Prevention Endeavors

By Walter G. Chandler

Superintendent of Transportation, Brooklyn Edison Company, Inc.

$I = \frac{E}{R}$ together with its numerous formula cousins probably is not aware that there exists in another field of work a formula which might be considered crude in its make-up and yet this queer combination of letters has proved an excellent aid in arriving at logical conclusions on those occasions when automobile drivers are studying ways and means to prevent accidents.

M.P.H. $\times$ 1½ = F.P.S. is the formula in mind and one which is used quite often by our Company's 600 odd drivers. When spelled out, it reads *"Miles per hour times one and one half equals feet per second."* Thinking in terms of feet per second furnishes base figures upon which the average driver who is interested in preventive endeavors may quickly know how far his car may travel while he is thinking and acting when an emergency stop must be made. This period of time is generally known as reaction time and might be thought of as that period of time starting the very instant a driver sees a hazard, which only too frequently spells death, and finishing the moment the driver desperately places his foot on the brake pedal. After having experienced many reaction tests both in the street and indoors through the aid of devices designed for both places our drivers have learned that the reaction time of the average driver is .8 of a second. These drivers regard this period of time as a very important driving fundamental and with the formula just mentioned in mind together with a knowledge of the average reaction time they are able to very promptly picture to themselves what they call *reaction distance*. For example, at a speed of 20 M.P.H., or approximately 30 feet per second, they appreciate the very important fact that they will travel 8/10 of 30 or about 24 feet while they are reacting to an emergency situation.

In order to impress this driving fundamental on the minds of our drivers, in the latter part of the year 1932 we developed a field testing device which is generally referred to as the "Edison Boy Test." The "boy" is made of Balsa

MR. CHANDLER

wood and other suitable materials and fitted with an appropriate suit and roller skates to give a very realistic impression of a 12-year-old youngster. This matter is presented here in picture story form, Exhibits Nos. 1, 2, and 3, and shows what might have been one more sad story. Immediately after such an experience, an account of the "accident" is recorded, a copy of which is given the driver involved for his personal enlightenment. Exhibit No. 4 is a specimen copy.

This same "boy"—he is the ninth brother—acts as a "martyr" to the cause indoors when it is more practical to carry on such preventive endeavors. "He" much prefers indoor work because a little electrically-operated toy car is never allowed to hit "him."

Exhibit No. 5 is a picture of this device. As stated, the little car is electrically operated and it is controlled by the accelerator pedal which is mounted, of course, near the driver's seat. The moment the accelerator is depressed, the car starts moving and after a few split seconds the "boy" skates out from his hiding position directly in front of the moving car. The instant the driver sees the "boy" he shifts his foot, as speedily as he is able to, from the accelerator to the brake pedal. He has thus recorded his reaction time because through an electrical hook-up the very instant he saw the boy a split second stop watch was started and similarly the moment he touched the brake pedal the watch was stopped. The time will vary from .6 of a second to one second. The *reaction distance*, which would have been traveled had this been a street test, is indicated on a scale which may be seen in back of the reaction tester and for the sake of simplicity a speed of 20 M.P.H. or 30 F.P.S. are the figures used in nearly all tests. The marks on the scale are actual measurements in feet. For the purpose of observing both reaction distance and stopping distance at the same time, a sliding black bar is attached to the scale. This bar represents a stopping distance at a speed of 30 feet per second and it measures exactly 22 feet. This distance was chosen because many authorities have gone on record as stating that the average stopping distance at a speed of 20 M.P.H. of a vehicle equipped with four-wheel brakes is 22 feet.

This particular apparatus was developed in our Company, October, 1935, and very soon after it started operating we received requests for its use from Safety Councils, the New York Police Department, High Schools, civic and religious organizations, and other institutions. To date and outside of our own Company employees, 6,000 drivers of both sexes have taken the test. In this connection, while it was built primarily for educational purposes, it is possible that among the 6,000 folk just mentioned some friendly public relations may have also been developed.

As a result of these tests there are two things which have impressed us to no small degree, especially so, when we review in these United States of ours the all-time high in automobile killings which the year 1937 just disgracefully recorded. The first thing which impressed us was the lack of knowledge regarding driving fundamentals. Comparatively few realized that at speeds of

Exhibit 1, Left—An unexpectant driver at the start of an "Edison Boy" test. A spotlight, concealed in dummy fire hydrant (L-1) projects an invisible light beam into a photoelectric cell (C-1) on the opposite side of the street similarly concealed. The truck interrupts the first light beam (L-1 to C-1) starting a stop watch in control box (B).

Exhibit 2, Right—The truck continuing, travels 36 feet at which point it interrupts the second light beam (L-2 to C-2) stopping the stop watch, thus with a record of distance and time the speed of the truck is determined as 20 miles per hour. Simultaneously from behind a parked car the boy is automatically released 32 feet away by remote control and skates into the path of the oncoming truck.

Exhibit 3, Left—The distance traveled while the driver reacts to the emergency plus the distance necessary to stop the truck after the brakes are applied is too great. The truck strikes the "Boy."

certain M.P.H. they were moving at undreamed of feet per second. And when they saw their *reaction distances indicated* on the scale they were startled. The second thing with which those thousands of folk impressed us was their eagerness to learn about driving fundamentals.

We, of course, will never know but we might make a guess as to what percentage of those drivers who hurled 40,000 people into eternity last year knew about just plain driving fundamentals.

Since the year 1932 other preventive accident work has been pursued but the endeavors just described received the greatest attention. Believing it may be of interest to view our vehicle accident record during the period just mentioned we here present Exhibit No. 6 which shows comparisons of mileages and automobile accidents involving personal injuries.

Considerable credit must be given our 600 drivers who brought down the personal injury curve to a new low in 1937 but there are others who contributed greatly in this endeavor and I refer to our executives whose inspiration, council, and kindly aid were very important factors of help.

For those of my kind readers who may be interested in knowing how much their fellow driver friends might know about driving fundamentals may I suggest that you question them regarding their probable reaction time and also find out if they appreciate fully that M.P.H. $\times$ 1½ = F.P.S. and that this formula may have a direct connection with sudden death.

RESUSCITATION PAMPHLET

"Resuscitation in Gas Poisoning, Electric Shock and Drowning"—a manual of the standard technique of resuscitation, contains valuable explanatory notes which prepare the reader to save human life through the knowledge and practice of this method.

This fifteen-page booklet is available at the E.E.I. General Office, 420 Lexington Ave., New York, at the following prices:

1- 9 copies....	$0.10 each
10- 99 copies....	.08 each
100-499 copies....	.06 each
500-999 copies....	.04 each
1000 copies or over..	.03 each

Brooklyn Edison Company Inc
Transportation Department
"Edison Boy" Field Test

Made for the purpose of furthering knowledge in the Important Business of Accident Prevention

DRIVER John Jones DATE June 10, 1933 TIME 10:35 AM

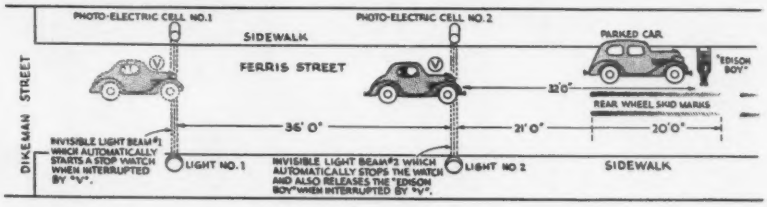


PHOTO-ELECTRIC CELL NO.1
PHOTO-ELECTRIC CELL NO.2
SIDEWALK
PARKED CAR
FERRIS STREET
"EDISON BOY"
DIKEMAN STREET
REAR WHEEL SKID MARKS
36' 0"
21' 0"
20'0"
INVISIBLE LIGHT BEAM #1 WHICH AUTOMATICALLY STARTS A STOP WATCH WHEN INTERRUPTED BY "V".
LIGHT NO. 1
INVISIBLE LIGHT BEAM #2 WHICH AUTOMATICALLY STOPS THE WATCH AND ALSO RELEASES THE "EDISON BOY" WHEN INTERRUPTED BY "V".
LIGHT NO 2
SIDEWALK

Mr John Jones

You hit our "boy today. If he had been a real child you would probably have killed him.

We hope you will think over carefully the following facts

1. You struck the "boy."
2. You were travelling 20 miles per hour as you approached the "boy." (The time required to drive from light beam #1 through light beam #2, a distance of 36 feet, was recorded on a split second stop watch. These figures, representing feet per second, were then converted to miles per hour.)
3. At this speed, you probably believed you could "stop on a dime," but as a matter of fact, your total stopping distance was 41 feet - 20 feet braking distance plus 21 feet reaction distance. Your reaction distance represents a reaction time of 7/10 of a second
4. You travelled a greater distance while you were reacting, or thinking and acting to apply your brakes, than you did after your brakes had been applied.

The main purpose of this test has been fulfilled if you have been aroused to the importance of REACTION TIME.

I acknowledge receiving a duplicate copy of this report

Driver John Jones

Gerald Byrnes Supervisor

Test Conducted by Field Inspectors
P J Connell and T Fredricks

Exhibit 4.

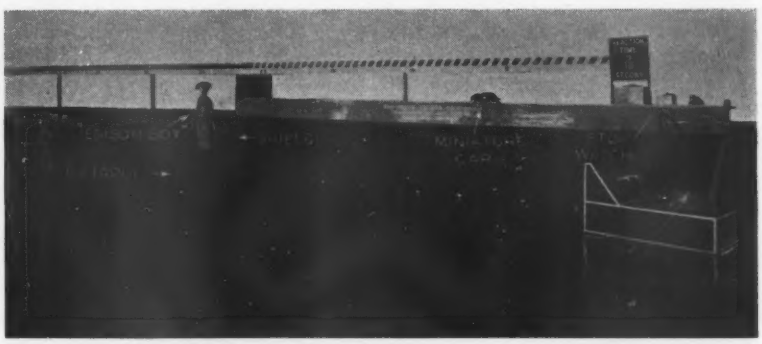


Exhibit 5—Transportation Department Reaction Tester.

Brooklyn Edison Company Inc
Transportation Department

Comparison of Mileages and Automobile Accidents Involving Personal Injuries
1932 - 1933 - 1934 - 1935 - 1936 - 1937

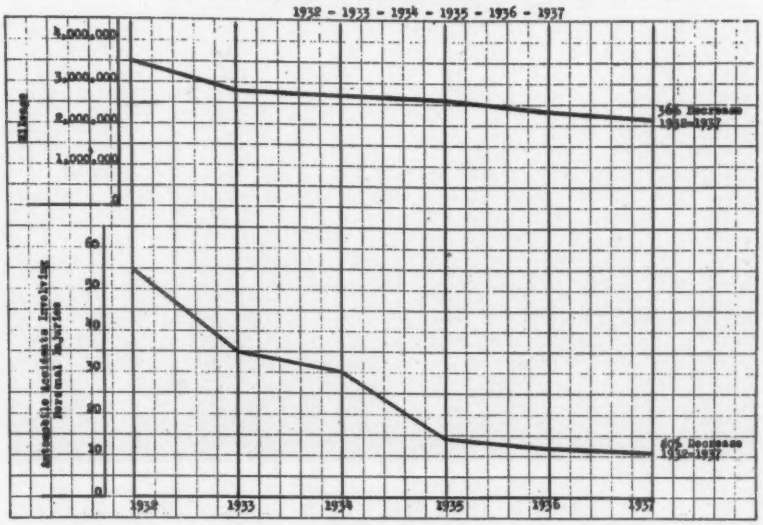


Exhibit 6.

THE CHAIRMAN TAKES THE FLOOR AT AN E.E.I. COMMITTEE MEETING

A camera shot by Mr. R. N. Conwell at the Cincinnati meeting last month of the Electrical Equipment Committee. Mr. J. F. Fairman, chairman, is standing. Seated are Messrs. R. C. Herweh, A. E. Silver, R. A. Hentz and J. O'R. Coleman, secretary of the committee.

MORE PICTURES SNAPPED BY MR. CONWELL AT THE ELECTRICAL EQUIPMENT COMMITTEE MEETING

Among those pictured are Messrs. Fairman, E. S. Fitz, B. Van Ness, A. G. Dewars, M. Dubose, H. S. Fitch, D. M. Jones, R. A. Hentz, E. S. Fields, R. C. Herweh, H. C. Forbes, C. Healey and J. O'R. Coleman.

Program—Fifth Annual Sales Conferences, Edison Electric Institute

March 29-April 1, 1938

Edgewater Beach Hotel, Chicago, Illinois

Morning Session—March 29

Presiding, DAVIS M. DEBARD, Chairman, Sales Committee

Introductory Remarks by the Chairman.

"—But The Most Important of These Is Men."

DR. A. S. BENNION, Utah Power & Light Co., Salt Lake City, Utah.

Organized Training for the Sales Department.

C. A. EASTMAN, Ebasco Services, Inc., New York, N. Y.

Sales Department Survey and Analysis.

R. E. FISHER, Pacific Gas and Electric Co., San Francisco, Cal.

Afternoon Session—March 29

Presiding, M. E. SKINNER, Buffalo, Niagara & Eastern Power Corp., Buffalo, N. Y.

Our Goal From Here.

M. E. SKINNER, Chairman, National Better Light-Better Sight Bureau.

Oh Say Can You See?

DR. H. E. PINE, President, The American Optometric Association, Inc.

Saving Sight Through Cooperation.

MRS. WINIFRED HATHAWAY, Associate Director National Society for Prevention of Blindness.

Five Years of Better Light-Better Sight.

Ten-minute presentations by:

JULIUS DANIELS, Boston Edison Co., Boston, Mass. (Eastern Section)

C. A. COLLIER, Georgia Power Co., Atlanta, Ga. (Southeastern Section)

J. E. NORTH, The Cleveland Electric Illuminating Co., Cleveland, Ohio. (Middle West Section)

W. E. HOLLAND, Dallas Power & Light Co., Dallas, Texas. (Southwestern Section)

E. G. STAHL, San Joaquin Light & Power Corp., Fresno, Cal. (Western Section)

Lighting Sales March On

M. N. WATERMAN, Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y. A Picturization—Apologies to the March of Time.

Morning Session—March 30

Presiding, D. M. DEBARD

The National Adequate Wiring Program.

W. E. SPRACKLING, Vice-President, Anaconda Wire & Cable Co., New York, N. Y., Chairman, Adequate Wiring Bureau.

Broadening Home Service Activities.

MISS SARAH HARDING HUNTER, the Cleveland Electric Illuminating Co., Cleveland, Ohio.

This Era of Dealer Cooperation.

S. P. VECKER, Carolina Power & Light Co., Raleigh, N. C.

The Utilities' Stake in the New Housing Program.

BRUCE WILSON, Director of Education, Federal Housing Administration.

Formal Luncheon—March 30

Address: C. W. KELLOGG, President, Edison Electric Institute.

Afternoon Session—March 30

Presiding, G. E. WHITWELL, Philadelphia, Electric Co., Philadelphia, Pa.

Past Progress and Immediate Potentialities of the Modern Kitchen Bureau Program.

G. E. WHITWELL, Chairman, Modern Kitchen Bureau.

Value and Characteristics of Electric Cooking, Water Heating and Refrigeration Loads.

R. R. HERRMANN, Manager, Rate Department, Northern States Power Co., Minneapilis, Minn.

Recent Dvelopments in Electric Water Heating.

KINSEY M. ROBINSON, President, Idaho Power Co., Boise, Idaho.

Meeting Local Competition in the Refrigeration Field.

A. A. BROWN, Oklahoma Gas & Electric Co., Oklahoma City, Okla.

Résumé of Reports from Regional Directors.

H. L. MARTIN, Manager, Modern Kitchen Bureau.

Manufacturers' Present Thinking on the Modern Kitchen Bureau.

C. E. SWARTZBAUGH, Chairman, Business Development Committee, NEMA.

Morning Session—March 31

Presiding, D. M. DEBARD

Running Water — The Farmer Deserves It.

H. E. DEXTER, Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.; Chairman, Electric Water Systems Council.

Commercial Electric Cooking—A Load Builder.

P. M. ALDEN, Philadelphia Electric

(Continued on next page)

Power Sales Conference

Friday, April 1, 1938

Edgewater Beach Hotel, Chicago, Illinois

Closed Sessions—Utility Representatives Only

Presiding, J. F. GASKILL, Chairman, Industrial Power and Heating Committee

Morning Session—April 1

No Industry is Completely Electrified

A. D. MCLAY, Detroit Edison Co., Detroit, Mich.

Power Costs in Industry

Electric Cooking and Baking

(Results of exhaustive tests in Buffalo, N. Y., Hartford, Conn., and Philadelphia, Pa.)

HARRY RESTOFSKI, West Penn Power Co., Pittsburgh, Pa.

Afternoon Session—April 1

Dramatizing Collateral Advantages and Savings of Purchased Electric Power

J. H. COATES, Ebasco Services, Inc., New York, N. Y.

Competition

Trends in Competition and Methods of Meeting It—E. L. FLEMING, Public Service Electric & Gas Co., Newark, N. J.

New Diesel Competition—F. A. NEWTON, Commonwealth & Southern Corp., New York, N. Y.

Steam Competition—W. J. KYLE, Public Utility Engineering & Service Corp., Chicago, Ill.

Fuel Competition—A. C. SHEPHERD, Cleveland Electric Illuminating Co., Cleveland, Ohio.

Sales Conference

(*Continued from preceding page*)

Co., Philadelphia, Pa.; Chairman, Commercial Electric Cooking Council.

Developing Increased Use of Electricity Among Rural Customers.

D. E. KARN, Vice-President and General Manager, Consumers Power Co., Jackson, Mich.

The Chemurgic Challenge.

WHEELER MCMILLEN, Editorial Director, Country Home Magazine President, National Farm Chemurgic Council.

Afternoon Session—March 31

Presiding, G. E. WHITWELL

Work of Batelle Memorial Institute.

DR. C. F. HIRSHFELD, The Detroit Edison Co., Detroit, Mich.

"Package" Diesel Units and Their Future.

R. K. EVANS, Vice-President General Motors Corp., Detroit, Mich.

Selling The Profitable Load.

H. C. THUERK, Utility Management Corp., New York, N. Y.

Fourteen Years in the Utility Business.

C. J. STRIKE, President, Northwestern Public Service Co., Huron, S. D.

Missouri Association of Public Utilities Meeting in April

THE annual State convention of the Missouri Association of Public Utilities will be held this year on April 20, 21 and 22 in St. Louis, Mo., at Hotel Jefferson.

Among the speakers will be: Floyd W. Parsons, New York City, magazine writer and editorial director of *Gas Age;* A. A. Nichoson, New York City, manager of personnel, The Texas Company; W. C. Beckjord, New York City, vice-president, American Gas Association, and general manager of Columbia Gas and Electric Corporation; L. A. Hawkins, Schenectady, N. Y., executive engineer of research, General Electric Company; Cleveland A. Newton, St. Louis, Mo., attorney for the Mississippi Valley Association; N. T. Veatch, Kansas City, Mo., consulting engineer; L. H. Egan, St. Louis, Mo., president, Union Electric Company of Missouri: J. B. Wilson, president, Laclede Gas Light Company; B. F. Dickmann, Mayor of St. Louis, Mo.

Among the subjects will be: "Employee Spirit—the Pulse of Business," "Fundamental Research and Industrial Progress," "Water Softening." "Looking Forward in the Gas Industry," "National Legislation Affecting Industry," "What the Manufacturer Is Doing for Economical Utility Operations," "Yesterday, Today, and Tomorrow," "The Light Ahead," "Some Observations."

A get-together luncheon will be held at noon, April 21, and the annual dinner and entertainment will be in the evening, April 22. Chester C. Smith, president of the Association will preside at the business sessions and at the luncheon and banquet. A Safety Meeting and round table discussion of accident prevention will open the convention on April 20. The annual Open Forum for the discussion of timely utility subjects will be held on the afternoon of April 22. The annual statewide Employees' Speaking Contest will take place on the night of April 20.

Meeting for Public Utility Fleet Operators

THE Society of Automotive Engineers will hold a regional meeting for public utility fleet operators, at the Hotel Statler, Cleveland, April 28-29. The sessions will be open to attendance by all those interested, and discussion will be invited on the topics presented. No registration fees or other charges will be made.

The tentative program follows:

Thursday, April 28

10:00 A.M.—"Present and Future Trends in Public Utility Truck Bodies and Equipments," by Paul E. Hawkins, Baker-Raulang Company; N. P. Larsen, American Coach and Body Company.

2:00 P.M.—Plant Inspection Trip—Baker-Raulang Company, American Coach and Body Company and White Motor Company.

5:00 P.M.—Cleveland Section Tea.

6:30 P.M.—"Utilities Dinner"; Dinner Chairman, Art Townhill.
"Some Interesting Facts About T.V.A.," by F. A. Newton, The Commonwealth & Southern Corporation.

Friday, April 29

10:00 A.M.—"Application of Truck Chassis to Public Utility Use," by T. C. Smith, American Telephone and Telegraph Co.

2:00 P.M.—"High Pressure vs. Balloon Tires."
"Economy of Snow-Mud Tires vs. Conventional Tires with Chains," by J. E. Hale, Firestone Tire and Rubber Company.
"Engine Deposits — Cause and Effect," by Fred Heinlein, The Cincinnati Gas and Electric Company.
"The Importance of Periodic Motor Tune Up," by E. J. Gay, Ethyl Gasolene Corporation.

8:00 P.M.—Public Utility Fleet Supervisors' Conference Chairman, Robert H. Clark, Consolidated Edison Company of New York—Subjects to be discussed to be outlined later.

Edison Tower is Dedicated

DEDICATION ceremonies of the Edison Memorial Tower, located at Menlo Park, N. J., and described in the January issue of the BULLETIN, were held on February 11, the 91st anniversary of the birth of Thomas A. Edison.

The tower is 131 feet high, the beacon occupying the upper fourteen feet. Twelve electric lamps with a total capacity of 5200 watts light the tower, while eight 600-watt lamps set in sockets around the base serve as floodlights.

William Slocum Barstow, President of the Thomas Alva Edison Foundation, Inc., who donated the funds to build the tower, lighted the beacon for the first time by pressing a switch at 12:30 p.m. during the twentieth annual luncheon of the Edison Pioneers at the Hotel Astor. Mrs. Edward Everett Hughes, widow of Mr. Edison; Charles Edison, Assistant Secretary of the Navy, son of the inventor, and about 250 of Mr. Edison's former associates attended the luncheon to watch Mr. Barstow formally turn over possession of the memorial tower to the foundation in behalf of the Edison Pioneers.

Ceremonies led by 150 Boy Scouts were held at the base of the memorial in Menlo Park while the luncheon was being held in New York. The tower, built to replace a temporary steel structure which was partially destroyed by lightning on August 11, 1937, houses the "eternal light," which has burned continuously since Mr. Edison touched a button to set it aglow on October 21, 1929, during the celebration of Light's Golden Jubilee.

Alfred W. Dater

ALFRED WARNER DATER, vice-chairman of the Board of Directors of The Connecticut Power Company, died Feb. 21, 1938. Mr. Dater was born in Brooklyn, New York, Aug. 23, 1872. He was educated at Adelphia Academy, Brooklyn Polytechnic Institute and was graduated from Sheffield Scientific School of Yale University in 1895 with the degree of Bachelor of Philosophy.

Mr. Dater's first position was with the Pennsylvania Railroad in Fort Wayne, Indiana, as a machinist's helper. In the fall of 1897 he became assistant general manager of the King's County Electric Light and Power Company of Brooklyn, New York. The year following this company acquired the Edison Electric Illuminating Company and Mr. Dater was elected treasurer of the combined companies which office he held until he came to Stamford, Connecticut, to organize and become vice-president and treasurer of the Oven Equipment and Manufacturing Company in 1903. In 1904 he became affiliated with The Stamford Gas and Electric Company as treasurer and a director. In 1911 Mr. Dater was elected vice-president, in which capacity he served for six years, when he became its president. When The Stamford Gas and Electric Company merged with The Connecticut Power Company in July of 1936, he was elected vice-chairman of the Board of Directors of The Connecticut Power Company, of which he was a director, and chairman of The Stamford Gas and Electric Divisional Committee.

Mr. Dater was also president of the Stamford Savings Bank, president of the Morewood Realty Company, vice-president of the Stamford Water Company. He has also served as a director of the First-Stamford National Bank and Trust Company, the Western Connecticut Title and Mortgage Company and the Nazareth Cement Company of Nazareth, Pennsylvania. Twice president of the Stamford Community Chest, he served for many years as a vestryman and, of late, junior warden and treasurer of his church. For twenty-one years he was president of the Stamford Council, Boy Scouts of America and a member of the National Executive Board, Boy Scouts of America, vice-president of the Stamford Children's Home and trustee of the Stamford Home for the Aged. During the World War, Mr. Dater was connected with the United States Fuel Administration serving as chairman for the Stamford District and with the Naval Advisory Board.

C. M. Brewer

C. M. BREWER, President of the California Oregon Power Company, died March 2 in Medford, Ore., in his fifty-sixth year. Mr. Brewer entered the public utility industry as salesman in the new business department of the Commonwealth Power Company. A year later he went to Grand Rapids Muskegon Power Company in the same capacity.

In 1909 he became associated with the H. M. Byllesby & Company organization as sales manager of the Muskogee Gas & Electric; in 1910 was appointed sales manager at Mankato, Minn., for Northern States Power Company and was later transferred to Sand Point, Idaho, where he became operating manager of the Northern Idaho and Montana Power Company.

Mr. Brewer was transferred to Richmond, Calif., as manager of the Western States Gas & Electric Company. His next position was that of vice-president and general manager of Mountain States Power Company at Albany, Ore., to which he was appointed in 1919. Continuing in that office, he was elected to the same position with the California Oregon Power Company in 1929, moving to Medford. In 1931 he was elected president of both these companies, resigning his position with the Mountain States Power Company last year.

The National E.E.I. Engineering Conference

IN accordance with their established custom, all of the Engineering Committees of the Institute will hold their spring meetings at the Edgewater Beach Hotel in Chicago, May 2-4. These group meetings have proven to be of great value to the committees, as well as to the engineers of member companies who are not on any particular committee. At the spring meeting the work of the committees for the year is rounded up and final review given to many reports prepared by the various committees. These group meetings allow visiting engineers to attend the sessions of different committees in which they are particularly interested. They also allow a member of any one committee to become better acquainted with the work being done by the other committees.

The individual committee programs for these meetings are now being prepared by the chairmen and an announcement as to the principal subjects to be covered by the various committees at the meetings in May will be included in the April issue of the Bulletin.

On Tuesday evening a general meeting of all the committees will be held where broader engineering considerations confronting the industry will be reviewed. At this meeting President Kellogg will be the principal speaker.

Annual Group Meetings

NATIONAL ENGINEERING CONFERENCE
EDISON ELECTRIC INSTITUTE

May 2-4, 1938

Edgewater Beach Hotel

Chicago, Illinois

Accident Prevention Committee	May 2, 3
Electrical Equipment Committee	May 2, 3
Prime Movers Committee	May 2, 3
Hydraulic Power Committee	May 3, 4
Transmission and Distribution Committee	May 3, 4
General Dinner Meeting	May 3

President Kellogg—Principal Speaker

PLAN NOW TO ATTEND

Conference to Be Held on Public Utility Budgeting

WHAT are public utility companies doing regularly in the way of budgeting? An effort will be made to obtain detailed answers to that question in a conference arranged by The Controllers Institute of America, to be held Monday, April 25, at the Waldorf-Astoria Hotel, New York City. The conference has been called for 2:15 P. M. and the entire afternoon will be given to it. It will be open to controllers, budget officers and others of utility companies, and the C. I. A. has broadened that term to include, in addition to gas and electric and water companies, street railways, steam railroads, telegraph and telephone companies.

The conference will be a part of the Spring Conference of The Controllers Institute. It will be participated in almost exclusively by controllers and other officers of utility companies. An invitation is extended to representatives of utility companies generally to participate.

Mr. Francis B. Flahive, Controller of the Columbia Gas & Electric Corporation, is Chairman of this conference. Arrangements have been made, first, for a general presentation of the principles underlying budgeting by utility companies, after which members of the Committee will introduce discussions of operating budgets, capital budgets, and cash budgets. Opportunity will be provided for a general discussion by those in the conference.

When this conference was first proposed, several controllers of utility companies expressed the thought that the practices of such companies with respect to budgets were almost uniform, and that perhaps little could be learned from such a discussion. Upon closer examination, however, it was found that the details of operation of budgets of such companies vary widely; and further examination made it apparent that a great deal could be learned by a detailed examination of the subject.

It is believed that this meeting will be unique in that it will bring together controllers of utility companies in different fields and of varying sizes, and it is expected that the material to be developed will be of exceptional usefulness to such companies.

Controllers and other of utility companies who wish to attend should communicate with The Controllers Institute of America, at One East Forty-second Street, New York City, or with Mr. Flahive, for reservation cards.

SALES—ELECTRIC REFRIGERATORS

(Household Models Only)

MONTH OF JANUARY 1938-1937

	Month of January 1938	Month of January 1937	Month of December 1937
Total United States	104,984	171,405	109,542
Maine	347	472	256
New Hampshire	196	549	(32)
Vermont	225	370	383
Massachusetts	3,255	6,458	6,501
Rhode Island	462	1,491	620
Connecticut	1,397	4,257	4,027
Total New England	5,882	13,597	11,755
New York	9,599	16,815	15,588
New Jersey	2,584	6,676	6,505
Pennsylvania	10,428	15,738	7,426
Total Middle Atlantic	22,611	39,229	29,519
Ohio	6,405	9,498	6,846
Indiana	2,955	4,089	3,745
Illinois	9,239	13,824	8,338
Michigan	3,932	8,519	3,587
Wisconsin	2,248	4,906	2,780
Total East North Central	24,779	40,836	25,296
Minnesota	3,329	3,061	1,383
Iowa	1,684	3,700	1,735
Missouri	3,454	4,937	1,411
North Dakota	127	375	231
South Dakota	290	487	309
Nebraska	755	1,665	1,244
Kansas	1,012	2,694	984
Total West North Central	10,651	16,919	7,297
Delaware	268	287	(97)
Maryland	987	1,767	1,888
District of Columbia	1,117	914	1,505
Virginia	1,349	2,686	1,647
West Virginia	1,329	1,605	1,462
North Carolina	2,236	3,874	2,077
South Carolina	928	1,872	422
Georgia	1,687	4,094	(173)
Florida	1,736	4,403	2,276
Total South Atlantic	11,637	21,502	11,007
Kentucky	1,163	1,252	1,546
Tennessee	1,916	2,567	1,320
Alabama	1,011	1,497	1,061
Mississippi	556	837	445
Total East South Central	4,646	6,153	4,372
Arkansas	548	634	402
Louisiana	1,654	1,493	436
Oklahoma	1,546	1,344	746
Texas	4,619	6,160	5,141
Total West South Central	8,367	9,631	6,725
Montana	325	585	262
Idaho	518	942	319
Wyoming	99	270	172
Colorado	823	1,600	927
New Mexico	131	269	132
Arizona	687	650	331
Utah	866	817	642
Nevada	141	190	119
Total Mountain	3,590	5,323	2,904
Washington	3,139	2,997	1,038
Oregon	1,565	1,361	779
California	8,117	13,857	8,850
Total Pacific	12,821	18,215	10,667

Figures based on report by the NEMA on Net Sales to Dealers and Jobbers.

Characteristics and Sag and Tension Calculations of Aluminum Cable Steel Reinforced

(*Continued from page 94*)

the sag curves are calculated from a constant tension at any specified temperature in all spans. This constant tension is established by the ruling span, which may be defined as a theoretical span length in which the tensile behavior of the conductor under changes in temperature and loading will most closely approach the behavior of the conductor on a series of spans of varying length, with flexible supports between dead ends. A satisfactory rule is to choose the ruling span as average span plus two-thirds of the difference between maximum span and average span between dead ends. Extreme refinement is not necessary and usually the same ruling span will be suitable for several or possibly all sections of a line between dead ends. If the conductor is not to be prestretched the stringing chart will be based on the initial sag and tension chart as in this case. If the conductor is to be prestretched during erection to give it the same permanent "set" that was allowed for in the final sag calculations the stringing chart will be made from the final sag and tension chart shown on Plate 9.

As suggested in Mr. Noyes' paper, previously mentioned, a conductor may be over pulled during stringing to give it a small part of its permanent "set." If this is done, the stringing sags will be calculated by using final stress-strain diagrams after stressing to the tension to which the conductor is to be overpulled.

This concludes the subject matter of my paper. The Aluminum Company has a large assortment of sag and tension charts, test records, and other technical data which it has not been practical to include in this apper. This information is available to the industry and inquiries are always welcome.

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CONVENTIONS AND MEETINGS

MARCH

16-18 Northwest Electric Light and Power Association, Business Development Conference, Medford, Ore.
21-22 Oklahoma Utilities Association, Annual convention, Biltmore Hotel, Oklahoma City, Okla.
28-31 Annual Sales Conference, EEI, Edgewater Beach Hotel, Chicago, Ill.

APRIL

7-8 Missouri Valley Electrical Association, Engineering conference, Omaha, Neb.
7-8 Pacific Coast Electrical Association, Spring conclave, Fresno, Calif.
13-15 American Institute of Architects, New Orleans, La.
13-15 Midwest Power Conference, LaSalle Hotel, Chicago, Ill.
18-22 Producers Council, Inc., New Orleans, La.
20-22 Missouri Association of Public Utilities, Jefferson Hotel, St. Louis, Mo.
20-23 Northwest Electric Light and Power Association, Engineering and Operating Section, Vancouver, B. C.
20-30 National Electrical and Radio Exposition, New York, N. Y.
21-23 Southeastern Electric Exchange, Annual convention, Edgewater Gulf Hotel, Biloxi, Miss.
27-30 Electrotechnical Society, Savannah, Ga.
29 Maryland Utilities Association, Annual Meeting, Lord Baltimore Hotel, Baltimore, Md.

MAY

2-5 Chamber of Commerce of the U. S. A., Washington, D. C.
2-5 Engineering Committees, Edison Electric Institute, Edgewater Beach Hotel, Chicago, Ill.
9-13 National Fire Protection Association, Atlantic City, N. J.
15-20 National Electrical Manufacturers Association, Hot Springs, Va.
22-26 National Electrical Wholesalers Association, Hot Springs, Va.
23-26 National Association of Purchasing Agents, St. Louis, Mo.
26-27 Pacific Coast Electrical Association, Annual convention, San Francisco, Calif.
27-31 Westinghouse Agent-Jobbers Association, The Homestead, Hot Springs, Va.
31 Heating Piping and Air Conditioning Contractors National Association, Boston, Mass.

JUNE

1-2 Heating Piping and Air Conditioning Contractors National Association, Boston, Mass.
6-9 *EDISON ELECTRIC INSTITUTE, Atlantic City Auditorium, Atlantic City, N. J.
20-24 American Institute of Electrical Engineers, Washington, D. C.
20-24 American Society of Mechanical Engineers, St. Louis, Mo.
22-24 Canadian Electrical Association, annual convention, Seigniory Club, Province of Quebec, Canada.

SEPTEMBER

7-9 Pennsylvania Electrical Association, Bedford Springs Hotel, Bedford Springs, Pa.
12-15 National Electrical Contractors Association, Book-Cadillac Hotel, Detroit, Mich.

OCTOBER

3-7 National Restaurant Association, Chicago, Ill.
10-14 American Gas Association, Atlantic City, N. J.
10-14 National Safety Council, Stevens Hotel, Chicago, Ill.
24-28 National Electrical Manufacturers Association, Palmer House, Chicago, Ill.